# Air Quality Monitoring

## Cold Lake, Bonnyville and Elk Point Areas

March 2001 to February 2002 — Final Report


### Summary

Alberta Environment conducts mobile air quality surveys each year as part of its air quality monitoring program. These monitoring surveys are unannounced and use the department's *Mobile Air Monitoring Laboratory* (MAML). Alberta Environment conducted a mobile, ambient air quality monitoring survey in the Cold Lake, Bonnyville and Elk Point areas of Alberta. The study consisted of four surveys, over four seasons, for one year. Pollutants measured by the MAML included carbon monoxide, oxides of nitrogen, ozone, particulates, hydrocarbons, sulphur dioxide, hydrogen sulphide, total reduced sulphur and ammonia. The objectives of monitoring this area were:

(1) to address odour complaint issues,
(2) to determine concentrations of air pollutants representative of the monitored locations near facilities and residences in the survey area,
(3) to provide data to support air quality monitoring and modelling activities that have been conducted in the area, and
(4) to map the distribution of sulphur dioxide, nitrogen dioxide and ozone for the purpose of determining the need for a passive network.

During this survey, the mobile lab monitored air quality for twenty days at sixteen sites in the Cold Lake, Bonnyville and Elk Point areas. Each site was monitored for a minimum of one hour to allow comparison with Alberta's one-hour ambient air quality guidelines. The survey obtained 122 hours of air quality monitoring information. Monitoring sites were selected to provide data near populated areas and near industrial sites. Data from other mobile surveys and from permanent monitoring stations in Alberta are also presented in this report, for comparison purposes. This report presents the results of the spring (March 26 to 30, 2001), summer (July 30 to August 3, 2001), fall (September 10 to 14, 2001) and winter (February 11 to 15, 2002) surveys.


Alberta
ENVIRONMENT


ISBN No 0-7785-2283-0 (Printed Edition)
ISBN No. 0-7785-2284-9 (On-Line Edition)
Pub No. T/667 (Printed, On-Line Edition)
**October 21, 2002**

## Findings

(1) With the exception of hydrogen sulphide, concentrations of air pollutants measured in the Cold Lake, Bonnyville and Elk Point areas were below Alberta's Ambient Air Quality Guidelines. Alberta has one-hour air quality guidelines for carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, hydrogen sulphide and ammonia. Maximum one-hour concentrations for these pollutants were:

- 5.4 times the one-hour guideline for hydrogen sulphide,
- 10% of the one-hour guideline for sulphur dioxide,
- 7% of the one-hour guideline for nitrogen dioxide,
- 57% of the one-hour guideline for ozone,
- 11% of the one-hour guideline for carbon monoxide, and
- <1% of the one-hour guideline for ammonia.

(2) The maximum one-hour hydrogen sulphide concentration of 0.054 ppm (parts per million) was detected at Site #12 (CNRL Wolf Lake facility). The one-hour guideline for hydrogen sulphide is 0.010 ppm. This maximum value was measured from 8:14 a.m. to 9:15 a.m. on September 12, 2001 about 50 metres from the plant. Fugitive emissions, or leakages, from the plant likely caused these elevated readings. Hydrogen sulphide levels at the remaining sites were less than 0.004 ppm.

(3) Hydrocarbon concentrations were also elevated at Site #12 on September 12, 2001. Maximum one-hour values at this location were 9.7 ppm for total hydrocarbons, 7.1 ppm for reactive hydrocarbons and 4.6 ppm for methane. Higher than normal hydrocarbon concentrations were also measured at Site #14 (Anadime Waste Management Processors) and Site #15 (CNRL Elk Point facility). Maximum total hydrocarbon concentrations at these two sites were 6.0 and 6.4 ppm, respectively. These hydrocarbon readings were likely caused by emissions from storage tanks on the adjacent facility properties. Alberta does not have ambient air quality guidelines for total hydrocarbons, however a total hydrocarbon concentration of 10 ppm is usually used as an indicator for further monitoring.

(4) Sulphur dioxide concentrations were low during the monitoring survey. The maximum one-hour concentration measured during the survey was 0.017 ppm. This value is one-tenth of the one-hour guideline for sulphur dioxide (0.172 ppm).

(5) Because of dust from traffic on gravel roads, elevated large particulate concentrations were measured at several monitoring sites. The highest one-hour particulate values were measured at the Canadian Crude Separators Waste Disposal plant site (Site #17) on August 3, 2001. Concentrations of total suspended particulates, inhalable particulates ($PM_{10}$) and respirable particulates ($PM_{2.5}$) at this time were 2281, 1188 and 72 $\mu g/m^3$ (micrograms per cubic metre), respectively. These higher than normal particulate levels were due to road dust during hot, dry weather. Normal rural concentrations of TSP, $PM_{10}$ and $PM_{2.5}$ in Alberta are about 25, 15 and 5 $\mu g/m^3$, respectively. However, particulate concentrations will vary substantially depending on wind speed, surface wetness and snow cover. There is no one-hour guideline in Alberta for particulate concentrations, although the 24-hour guideline for TSP is 100 $\mu g/m^3$ and the 24-hour Canada-wide Standard benchmark concentration for $PM_{2.5}$ is 30 $\mu g/m^3$.

## Monitoring Method

Alberta Environment monitored air quality using the *Mobile Air Monitoring Laboratory* (MAML) in the Cold Lake, Bonnyville and Elk Point areas from March 2001 to February 2002. Monitoring was conducted near industries and communities in these areas. Air quality was monitored on the following dates representing the winter, spring, summer and fall seasons.

- Spring (March 26 to 30, 2001).
- Summer (July 30 to August 3, 2001).
- Fall (September 10 to 14, 2001).
- Winter (February 11 to 15, 2002).

A total of 122 hours of data was collected at 16 sites. The monitoring sites were selected based on public concern, consultation with regional staff from Alberta Environment and observations by the MAML operators. Monitoring was conducted for a minimum of one hour at each location to allow comparison with Alberta's Ambient Air Quality Guidelines. The MAML monitoring sites are indicated in Figure 2 and Table 1 (pages 4 and 5).

## The Mobile Air Monitoring Laboratory

The MAML is a 27-foot (8.2 m) vehicle that has been specially designed and equipped to measure air quality. It houses a variety of instruments that continuously sample the air at specified time or distance intervals. The MAML is equipped with:

- A dual computer system custom-programmed to accept and record the measurement of air samples from each analyzer.
- A GPS (Global Positioning System) that identifies the MAML's location as it moves around Alberta.
- An exhaust purifying system that minimizes emissions from the vehicle.
- Two on-board generators that are also equipped with exhaust scrubbers.

The parameters measured by the MAML are indicated in Table 2 (page 5). Tables A1 and A2 in the Appendix (page 19) contain median and maximum air pollutant levels at all sites monitored during the survey. Tables A3 and A4 (pages 20 and 21) show median and maximum air pollutant concentrations at other locations in Alberta in 2001. Hourly air pollutant concentrations on each survey day are indicated in Tables A5 to A8 (pages 22 to 25). Weather conditions and the MAML operator's comments for each monitoring site are shown in Tables A9 to A12 in the Appendix (pages 26 to 29).

**Figure 1 Alberta Environment's Mobile Air Monitoring Laboratory (MAML).**

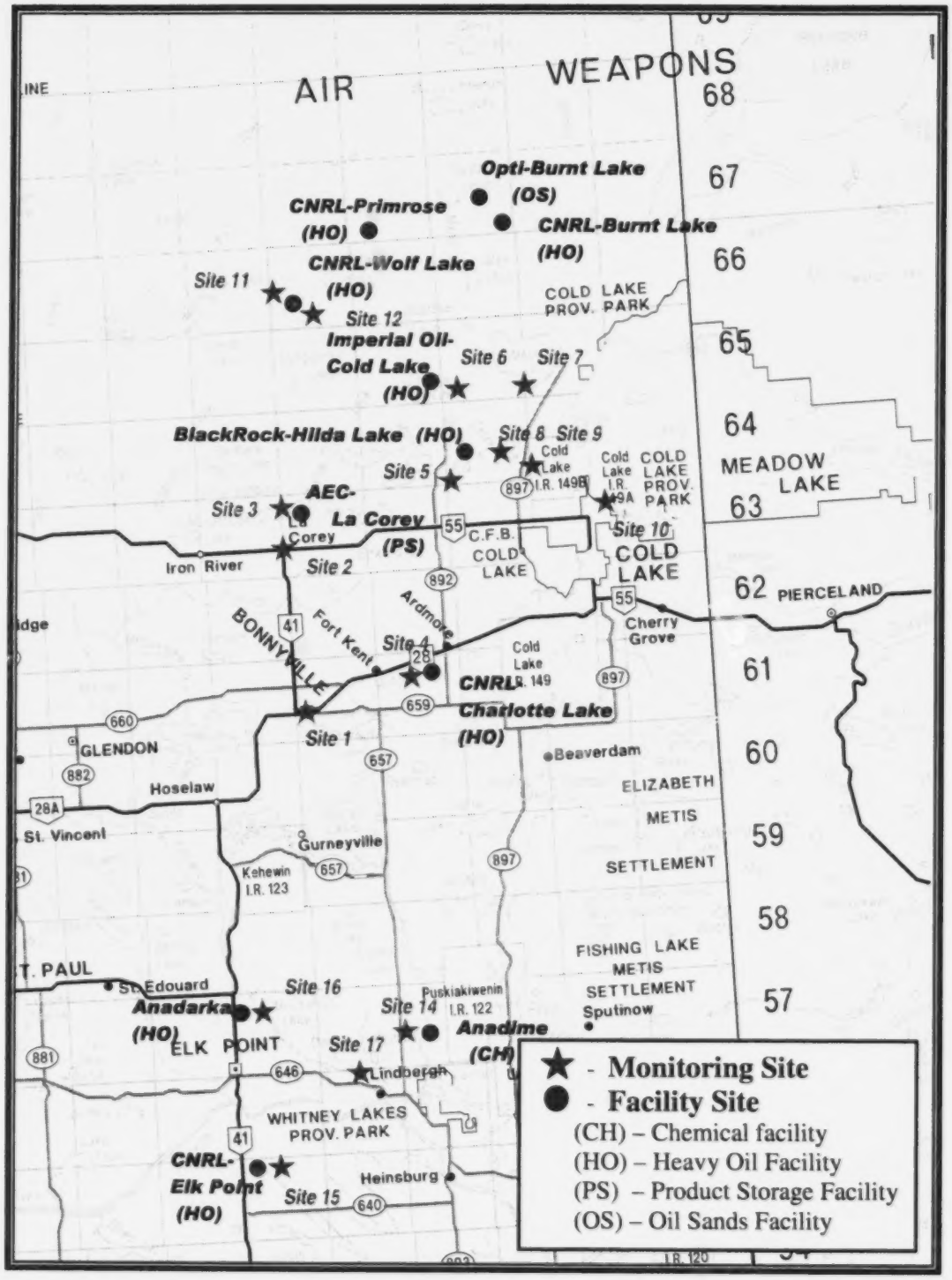


**Figure 2** **Locations monitored with the MAML (Cold Lake/Bonnyville/Elk Point areas).**

## Table 1 List of site numbers and associated locations monitored by the MAML.

| Site # | Monitoring Location | Dates Monitored | | | | |
|---|---|---|---|---|---|---|
| | | Spring | Summer | | Fall | Winter |
| | | Mar-01 | Jul-01 | Aug-01 | Sep-01 | Feb-02 |
| Site # 1 | 51 St and Lakeshore Dr (Town Centre-Bonnyville) | 26, 28 | 30 | | 10 | 11 |
| Site # 2 | La Corey Intersection @ Hwy 41 & Hwy 55 (13-63-6-W4M) | 26, 28 | 30 | 2 | 10 | 11 |
| Site # 3 | AEC Trucking Terminal on Rge 455 (12-30-63-5 W4M) | 26, 28 | 30 | 2 | 10, 12 | 11, 13 |
| Site # 4 | CNRL Charlotte Lake, 1 mi E & 2 mi S of Fort Kent (SE/SW 28-61-4 W4M) | 27, 28 | 31 | | 12 | 12 |
| Site # 5 | Residential Property (SW 6-64-3 W4M) | 27, 29 | 31 | 2 | 11 | 12, 14 |
| Site # 6 | Imperial Oil Cold Lake - various plants (8-33-64-3 W4M) | 27, 29 | 31 | 2 | 11, 13 | 12, 14 |
| Site # 7 | Residential Property (NE 1-65-3 W4M or SW 6-65-2 W4M) | 27, 29 | 31 | 2 | 11, 13 | |
| Site # 7a | Hwy 897 & Twp Rd 650 | | | | | 12 |
| Site # 8 | Residential Property (13-64-3 W4M) | 27, 29 | 31 | 2 | 11, 13 | 12 |
| Site # 9 | Cold Lake 1st Nations (1-64-3 W4M) | 27, 29 | 31 | 2 | 11, 13 | 12, 14 |
| Site #10 | Cold Lake Marina (18-64-1 W4M) | 27, 29 | 31 | | 11, 14 | |
| Site #11 | Sections 7, 8, 9, 10, 17-66-5 W4M (CNRL Wolf Lake, 2 locations, one | 28 | | 1 | 12 | 13 |
| Site #12 | upwind and one downwind) | 28 | | 1 | 12 | 13 |
| Site #14 | Anadime Waste Management processors (4-18-57-4 W4M) | 30 | | 1, 3 | 12, 14 | 13, 15 |
| Site #15 | CNRL Elk Point facility (15-28-55-6 W4M) | 30 | | 1, 3 | 12, 14 | 13, 15 |
| Site #16 | Anadarka Battery (12-19-57-6 W4M) | 30 | 30 | | 10 | 11 |
| Site #17 | Railway Ave (RR 52) & Main St. in Lindbergh & downwind of Canadian Crude Separator Facility located at NW 34-56-5 W4M. | | | 1, 3 | 12, 14 | 13, 15 |

## Table 2 Parameters monitored by the MAML (also includes minimum detection limits and operating ranges).

| Parameter Measured | Minimum Detectable Limit* | Operating Range** |
|---|---|---|
| sulphur dioxide ($SO_2$) | 0.6 ppb | 1 ppm |
| hydrogen sulphide ($H_2S$) | 0.6 ppb | 1 ppm |
| total reduced sulphur (TRS) | 0.6 ppb | 1 ppm |
| total hydrocarbons (THC) | 0.005 ppm | 20 ppm |
| reactive hydrocarbons (RHC) | 0.005 ppm | 20 ppm |
| methane ($CH_4$) | 0.005 ppm | 10 ppm |
| polycyclic aromatic hydrocarbons (PAHs) | 3 $ng/m^3$ | 1000 $^{ng/m3}$ |
| ozone ($O_3$) | 0.001 ppm | 0.5 ppm |
| nitrogen dioxide ($NO_2$) | 1.0 ppb | 1 ppm |
| nitric oxide (NO) | 1.0 ppb | 1 ppm |
| total oxides of nitrogen ($NO_x$) | 1.0 ppb | 1 ppm |
| total suspended particulates (TSP) | 1 $\mu g/m^3$ | 1.0 $g/m^3$ |
| inhalable particulates ($PM_{10}$) | 1 $\mu g/m^3$ | 1.0 $g/m^3$ |
| respirable particulates ($PM_{2.5}$) | 1 $\mu g/m^3$ | 1.0 $g/m^3$ |
| carbon monoxide (CO) | 0.1 ppm | 50 ppm |
| ammonia ($NH_3$) | 1.0 ppb | 5 ppm |
| wind direction (WDR) | 0 degrees | 360 degrees |
| wind speed (WSP) | 0 kph | 200 kph |
| temperature (Temp) | -40 °C | 50 °C |
| relative humidity (RH) | 0 % | 100 % |

ppb = parts per billion
ppm = parts per million
$ng/m^3$ = nanograms per cubic metre
$\mu g/m^3$ = micrograms per cubic metre
$g/m^3$ = grams per cubic metre
kph = kilometres per hour
°C = degrees Celsius
% = per cent

* The ***minimum detectable limit*** indicates the *minimum* amount of pollutant the instrument can measure.

** The ***operating range*** indicates the *maximum* amount of pollutant the instrument can detect. This limit is set to provide the optimum precision over that range. The upper limit can be raised, however, precision at the lower levels (where most levels are monitored) is then compromised.

## Alberta's Ambient Air Quality Guidelines

Alberta's Ambient Air Quality Guidelines[1] are established under Section 14 of the Environmental Protection and Enhancement Act (EPEA). EPEA provides for the development of guidelines and ambient environmental quality objectives for all or part of Alberta.

The Ambient Air Quality Guidelines are used for:

- Reporting on the state of the atmospheric environment in Alberta.
- Reporting to Albertans on the quality of air through an air quality index.
- Establishing approval conditions for regulated industrial facilities.
- Evaluating proposals to construct facilities that will have air emissions.
- Guiding special ambient air quality surveys.
- Assessing compliance near major industrial air emission sources.

Alberta's Ambient Air Quality Guidelines for one-hour concentrations of parameters monitored by the MAML are indicated in Table 3.

[1] *Alberta Ambient Air Quality Guidelines.* Alberta Environment. February 2000.

**Table 3 Alberta's Ambient Air Quality Guidelines for parameters measured by the MAML.**

| Air Quality Parameter | One-hour Guideline (ppm*) | Basis for Guideline |
|---|---|---|
| hydrogen sulphide | 0.01 | odour perception |
| ammonia | 2 | odour perception |
| carbon monoxide | 13 | oxygen carrying capacity of blood |
| nitrogen dioxide | 0.212 | odour perception |
| ozone | 0.082 | reduction of lung function and effects on tomatoes |
| sulphur dioxide | 0.172 | taste, odour perception and effects on bluegrass |

* Parts per million by volume.

## Sulphur Dioxide ($SO_2$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| 0.017 ppm | 0.172 ppm (based on taste, odour perception and effects on bluegrass) |

*Sulphur dioxide ($SO_2$) is a colourless gas with a pungent odour. In Alberta, it is estimated that 45% of $SO_2$ emissions are produced by natural gas processing plants while oil sands and power plants produce about 26% and 21% of $SO_2$ emissions, respectively[2]. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.*

$SO_2$ levels were below Alberta's one-hour guideline at all sites monitored in the survey area. The maximum one-hour concentration of 0.017 ppm was measured at Site #6 (Imperial Oil Cold Lake - Maskwa site) from 12:31 p.m. to 1:32 p.m. on September 13, 2001. This reading is about one-tenth of the one-hour guideline. The second highest $SO_2$ concentration was also measured at Site #6 (0.013 ppm). $SO_2$ levels at the remaining sites were very low with maximum values less than 0.005 ppm.

$SO_2$ concentrations measured in the Cold Lake area survey were generally lower than those measured during other MAML surveys in the province. Maximum one-hour levels ranged from 0.004 ppm in the Lethbridge area survey to 0.092 ppm in the Bow Corridor survey, compared to 0.017 ppm in the Cold Lake area survey. Maximum one-hour $SO_2$ concentrations in 2001 at permanent monitoring stations in Alberta ranged from 0.006 ppm (in west-central Alberta) to 0.231 ppm (north of Fort McMurray). Data for other locations are shown in Tables A3 and A4 (pages 20 and 21) in this report.

[2] *Environment Canada. 1998. 1995 Criteria Air Contaminant Emissions Inventory Summaries. Pollution Data Branch, Environment Canada.*

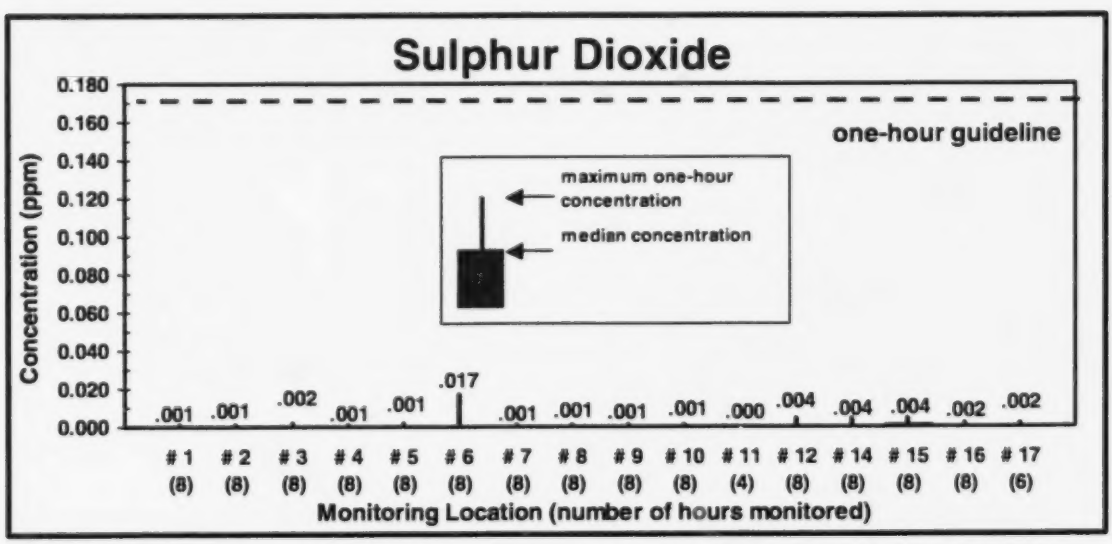
Sulphur Dioxide
Concentration (ppm)
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
one-hour guideline
maximum one-hour concentration
median concentration
.001 .001 .002 .001 .001 .017 .001 .001 .001 .001 .000 .004 .004 .004 .002 .002
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(8) (8) (8) (8) (8) (8) (8) (8) (8) (8) (4) (8) (8) (8) (8) (6)
Monitoring Location (number of hours monitored)

**Figure 3 One-hour median and maximum concentrations for sulphur dioxide.**

## Hydrogen Sulphide and Total Reduced Sulphur ($H_2S$ and TRS)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| $H_2S$ = 0.054 ppm | 0.010 ppm (based on odour perception) |
| TRS = 0.056 ppm | no guideline |

*Hydrogen sulphide ($H_2S$) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of $H_2S$ and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the Kraft pulping process, and animal feedlots. Natural sources of $H_2S$ include sulphur hot springs, sloughs, swamps and lakes.*

The one-hour guideline for $H_2S$ was exceeded for two hours on September 12, 2001 (8:14 a.m. to 10:15 a.m.) at Site #12 (CNRL Wolf Lake heavy oil facility). The maximum one-hour $H_2S$ concentration measured during this period was 0.054 ppm. This value is over five times the one-hour guideline of 0.010 ppm. The highest one-hour TRS concentration (0.056 ppm) was also recorded during this time period. The MAML was positioned about 300 metres northeast of the main flare stack and 50 metres from the plant site when these elevated numbers were recorded. High $H_2S$ levels at this location were likely due to fugitive emissions, or leakages, from the CNRL facility. Hydrocarbon levels were also elevated at this time. One-hour $H_2S$ concentrations were 0.003 ppm or lower at the other monitoring sites during the Cold Lake survey.

Maximum one-hour $H_2S$ concentrations measured during other MAML surveys in Alberta ranged from 0.002 ppm in the Bow Corridor to 0.054 ppm in the Lethbridge area. Based on 2001 data collected at permanent monitoring stations in Alberta, maximum one-hour $H_2S$ levels ranged from 0.005 ppm (Red Deer) to 0.038 ppm (Calgary East). $H_2S$ levels are generally higher near sources such as sewage treatment plants, and oil and gas processing facilities.

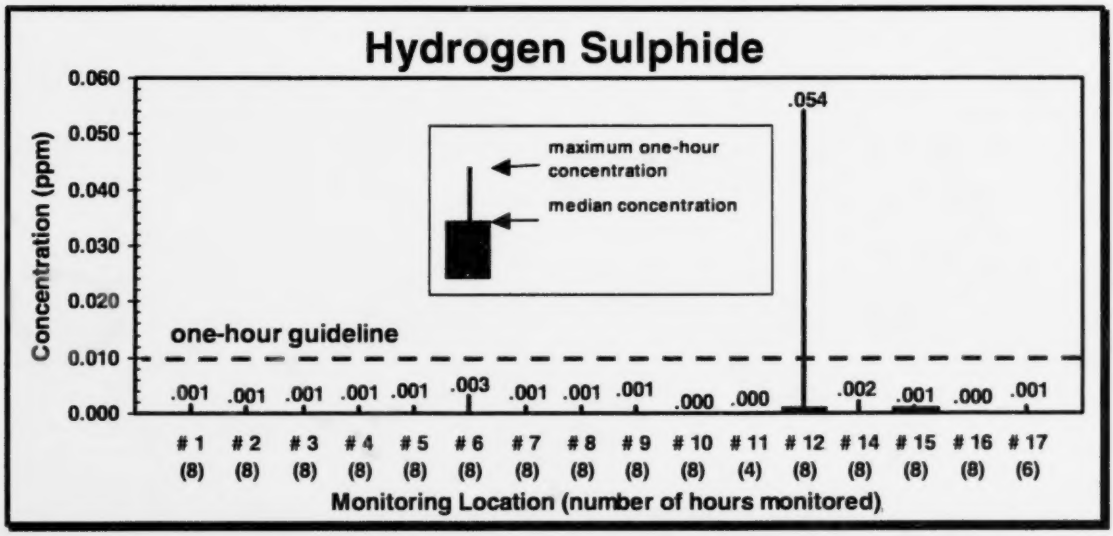
Hydrogen Sulphide
Concentration (ppm)
0.060
0.050
0.040
0.030
0.020
0.010
0.000
maximum one-hour concentration
median concentration
one-hour guideline
.001 .001 .001 .001 .001 .003 .001 .001 .001 .000 .000 .054 .002 .001 .000 .001
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(8) (8) (8) (8) (8) (8) (8) (8) (8) (8) (4) (8) (8) (8) (8) (6)
Monitoring Location (number of hours monitored)

**Figure 4** One-hour median and maximum concentrations for hydrogen sulphide.

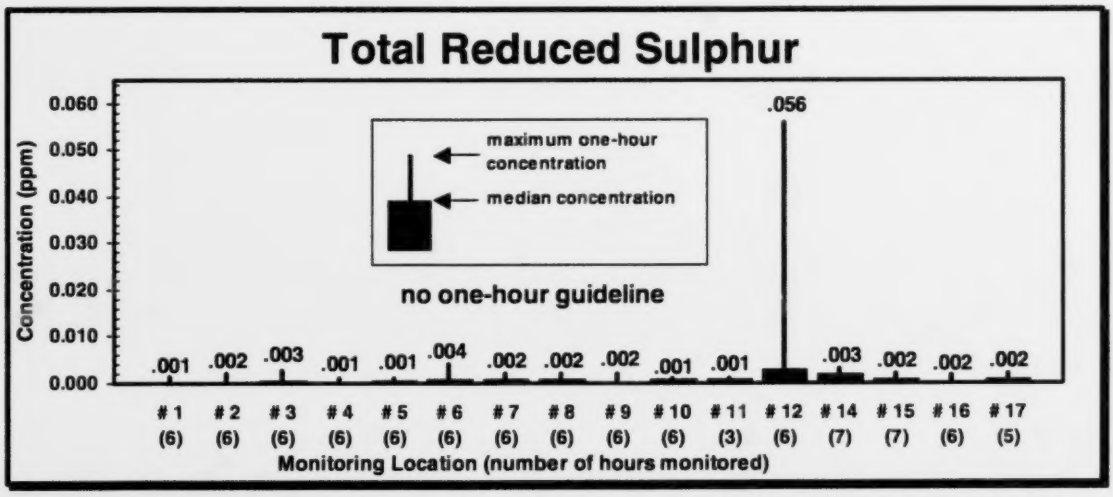
Total Reduced Sulphur
Concentration (ppm)
0.060
0.050
0.040
0.030
0.020
0.010
0.000
maximum one-hour concentration
median concentration
no one-hour guideline
.001 .002 .003 .001 .001 .004 .002 .002 .002 .001 .001 .056 .003 .002 .002 .002
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(6) (6) (6) (6) (6) (6) (6) (6) (6) (6) (3) (6) (7) (7) (6) (5)
Monitoring Location (number of hours monitored)

**Figure 5** One-hour median and maximum concentrations for total reduced sulphur.

## Hydrocarbons (THC, RHC and $CH_4$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| THC = 9.7 ppm | no guideline |
| RHC = 7.1 ppm | no guideline |
| $CH_4$ = 4.6 ppm | no guideline |

*The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane ($CH_4$) is the most common natural hydrocarbon in the earth's atmosphere. Specific reactive hydrocarbons (RHC) are important because they can contribute to summertime smog or be toxic at high concentrations. Some sources of hydrocarbons include vegetation, vehicle emissions, oil and gas processing, chemical processing, dry cleaning, fireplaces, natural gas combustion, aircraft traffic and evaporation of solvents. Normal background THC concentrations recorded in rural Alberta range from 1.5 to 2.0 ppm. Background hydrocarbons are primarily composed of $CH_4$ with a small contribution from RHC (about 0.2 ppm).*

Elevated hydrocarbon concentrations were measured at Site #12 (CNRL Wolf Lake heavy oil facility) on September 12, 2001 from 8:14 a.m. to 10:15 a.m. The maximum one-hour THC, RHC and $CH_4$ concentrations measured during this time period were 9.7, 7.1 and 4.6 ppm, respectively. Hydrocarbons at this location were likely caused by fugitive emissions, or leakages, from the nearby heavy oil facility. Elevated hydrocarbon levels were also detected at Site #14 (Anadime Waste Management Processors) and Site #15 (CNRL Elk Point facility). Maximum one-hour THC concentrations at these locations were 6.0 ppm (7:39 a.m. to 8:40 a.m. on August 3, 2001) and 6.4 ppm (4:11 p.m. to 5:12 p.m. on August 1, 2001), respectively. These elevated values were likely due to emissions from storage tanks on the adjacent facility properties. There are no air quality guidelines for THC, however Alberta Environment uses a benchmark concentration of 10 ppm as an indicator for further monitoring.

Maximum THC levels from other MAML surveys ranged from 2.2 ppm in Lethbridge to 32.4 ppm in the Grande Prairie area. Maximum one-hour THC levels at permanent monitoring stations ranged from 3.5 ppm (Calgary Northwest) to 25.0 ppm (Edmonton East) based on 2001 data.

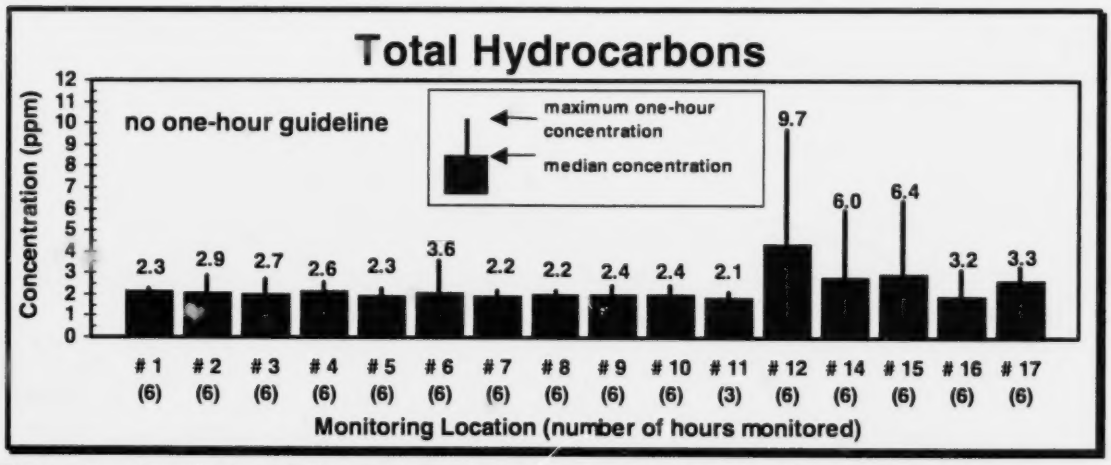


**Figure 6 One-hour median and maximum concentrations for total hydrocarbons.**

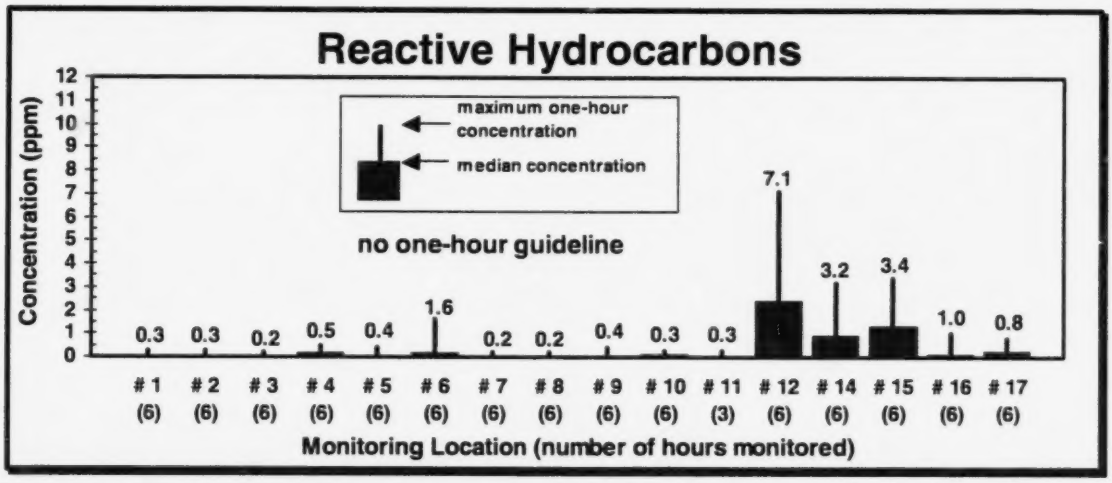
Reactive Hydrocarbons
Concentration (ppm)
maximum one-hour concentration
median concentration
no one-hour guideline
0.3 0.3 0.2 0.5 0.4 1.6 0.2 0.2 0.4 0.3 0.3 7.1 3.2 3.4 1.0 0.8
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(6) (6) (6) (6) (6) (6) (6) (6) (6) (6) (3) (6) (6) (6) (6) (6)
Monitoring Location (number of hours monitored)

**Figure 7** One-hour median and maximum concentrations for reactive hydrocarbons.

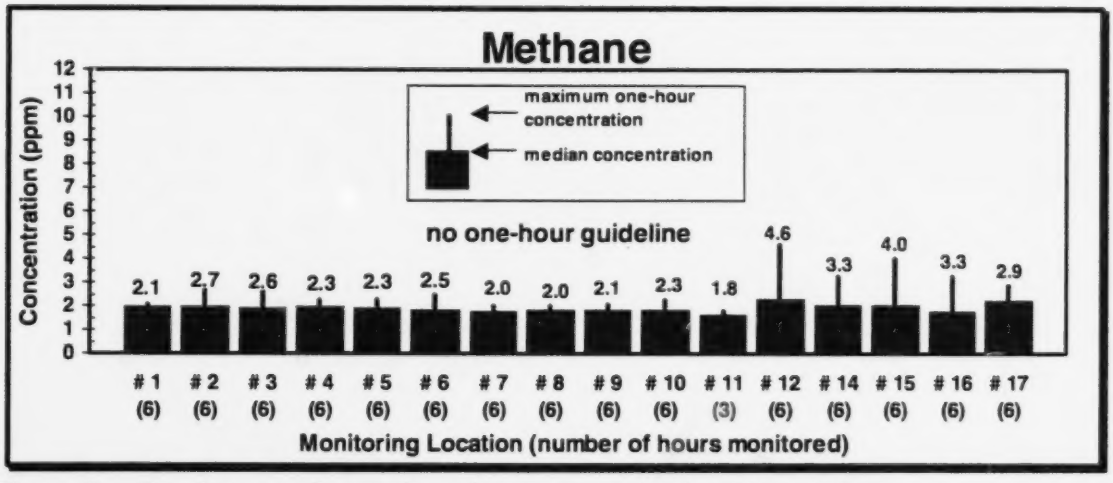
Methane
Concentration (ppm)
maximum one-hour concentration
median concentration
no one-hour guideline
2.1 2.7 2.6 2.3 2.3 2.5 2.0 2.0 2.1 2.3 1.8 4.6 3.3 4.0 3.3 2.9
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(6) (6) (6) (6) (6) (6) (6) (6) (6) (6) (3) (6) (6) (6) (6) (6)
Monitoring Location (number of hours monitored)

**Figure 8** One-hour median and maximum concentrations for methane.

## Particulates (TSP, $PM_{10}$ and $PM_{2.5}$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| TSP = 2281 $\mu g/m^3$ | no guideline |
| $PM_{10}$ = 1188 $\mu g/m^3$ | no guideline |
| $PM_{2.5}$ = 72 $\mu g/m^3$ | no guideline |

*Total suspended particulates (TSP) refer to all particles up to 500 micrometres in diameter (a human hair is about 70 micrometres in diameter) and are important primarily from a nuisance perspective. Particles less than 10 micrometres in diameter ($PM_{10}$) can be inhaled into the nose and throat while smaller particles, less than 2.5 micrometres in diameter ($PM_{2.5}$), can penetrate into the lungs. Sources of particulates include soil dust, road dust, agricultural dust (e.g., harvest), smoke from forest fires and recreational wood burning, vehicle exhaust emissions, brake and tire wear, and industrial emissions. Smaller particles ($PM_{2.5}$) originate in the atmosphere because of condensation and combustion from sources such as vehicle exhaust emissions, industrial emissions and wood burning.*

Because of traffic on gravel roads near the monitoring sites, high levels of large particulates were measured at several locations during the Cold Lake survey. Maximum TSP, $PM_{10}$ and $PM_{2.5}$ concentrations measured during the survey were 2281, 1188 and 72 $\mu g/m^3$ (micrograms per cubic metre), respectively. Maximum TSP levels from other MAML surveys ranged from 52 to 2305 $\mu g/m^3$ while maximum $PM_{10}$ levels ranged from 363 to 1287 $\mu g/m^3$. Maximum one-hour $PM_{2.5}$ levels ranged from 12 to 294 $\mu g/m^3$ in other MAML surveys.

The overall median TSP, $PM_{10}$ and $PM_{2.5}$ concentrations in the Cold Lake survey were 16, 10 and 2 $\mu g/m^3$, respectively. Median TSP levels from other MAML surveys range from 4 to 74 $\mu g/m^3$ and median $PM_{10}$ levels ranged from 3 to 40 $\mu g/m^3$. Median $PM_{2.5}$ levels range from 1 to 4 $\mu g/m^3$ in other MAML surveys. Data from other monitoring surveys and permanent monitoring stations in Alberta are presented in Tables A3 and A4 (pages 20 and 21).

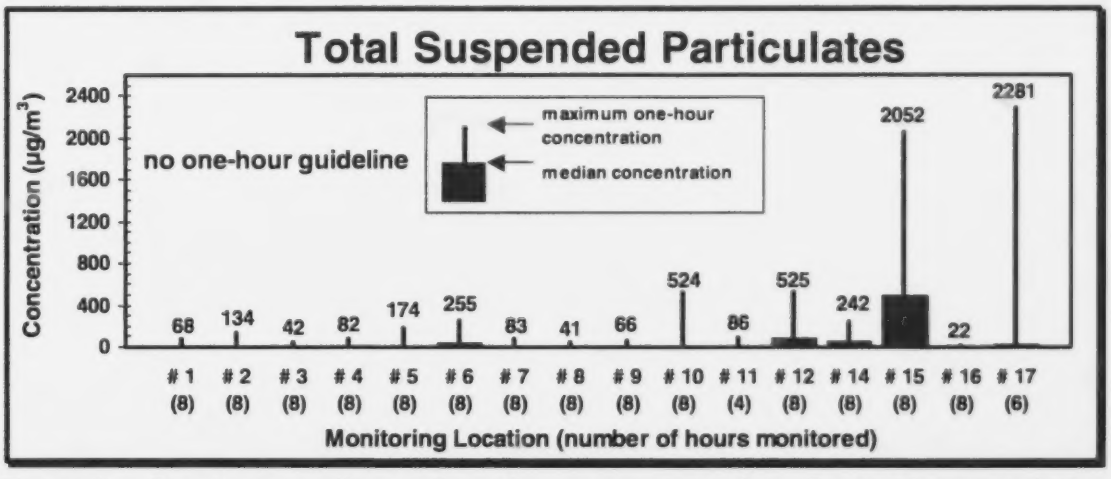


**Figure 9 One-hour median and maximum concentrations for total suspended particulates.**

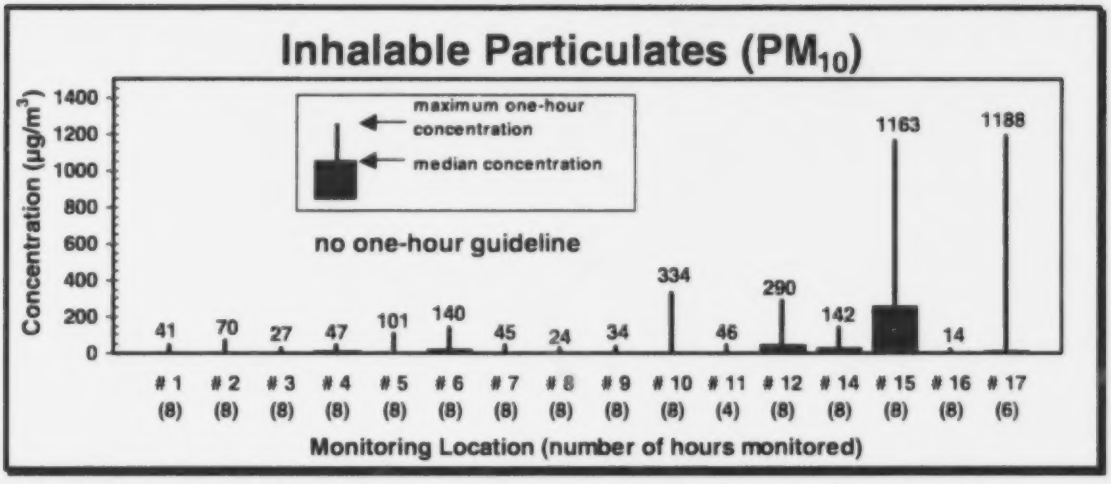


**Figure 10** One-hour median and maximum concentrations for inhalable particulates ($PM_{10}$).

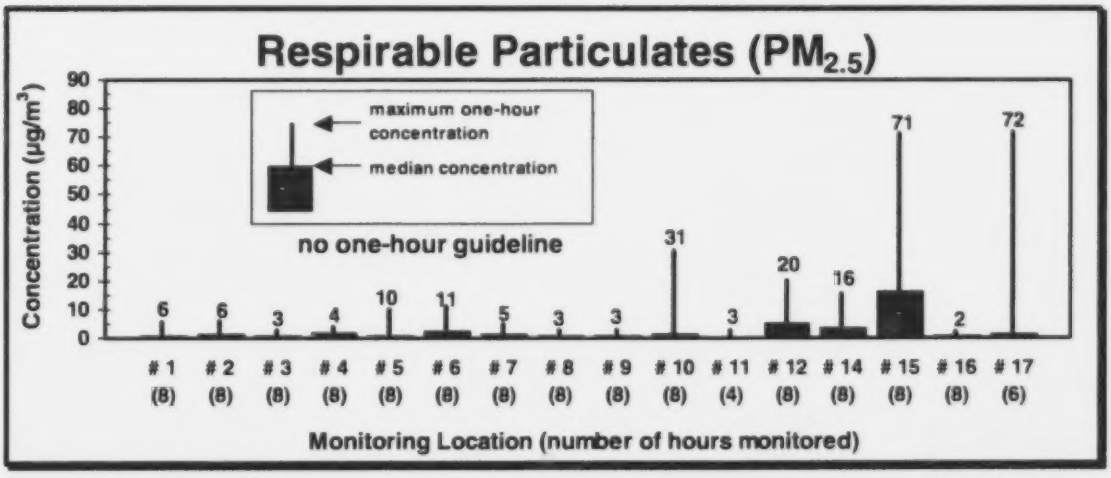


**Figure 11** One-hour median and maximum concentrations for respirable particulates ($PM_{2.5}$).

## Ozone ($O_3$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| 0.047 ppm | 0.082 ppm (based on reduction of lung function and effects on tomatoes) |

*Ozone in the lower atmosphere is produced by the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight, and transport of $O_3$ from the upper atmosphere to ground level. Transport from the upper atmosphere is likely the dominant ozone producing process in the fall, winter and early spring seasons. $O_3$ concentrations are generally lower in urban centres due to the destruction of $O_3$ by nitric oxide.*

$O_3$ concentrations in the Cold Lake area survey were generally highest in the afternoon and in the spring and summer seasons. These daily and seasonal variations are typical of other locations in Alberta. The maximum one-hour $O_3$ concentration (0.047 ppm) was recorded on the afternoon of March 28, 2001 at Site #11 and on the afternoon of August 2, 2001 at Site #9. This maximum $O_3$ value is 57 per cent of the one-hour guideline. Based on 2001 data, typical maximum $O_3$ levels at permanent stations in Alberta ranged from 0.055 to 0.083 ppm.

The median $O_3$ concentration in the survey area ranged from 0.023 ppm at Site #3 to 0.037 ppm at Site #9. Higher $O_3$ levels are observed in the afternoon because of more sunlight, warmer temperatures and more vertical mixing of the atmosphere. All of these factors lead to higher background $O_3$ concentrations.

The median $O_3$ concentration for the entire Cold Lake area survey was 0.031 ppm. Typical median $O_3$ levels at rural locations in Alberta ranged from about 0.020 to 0.048 ppm based on 2001 data.

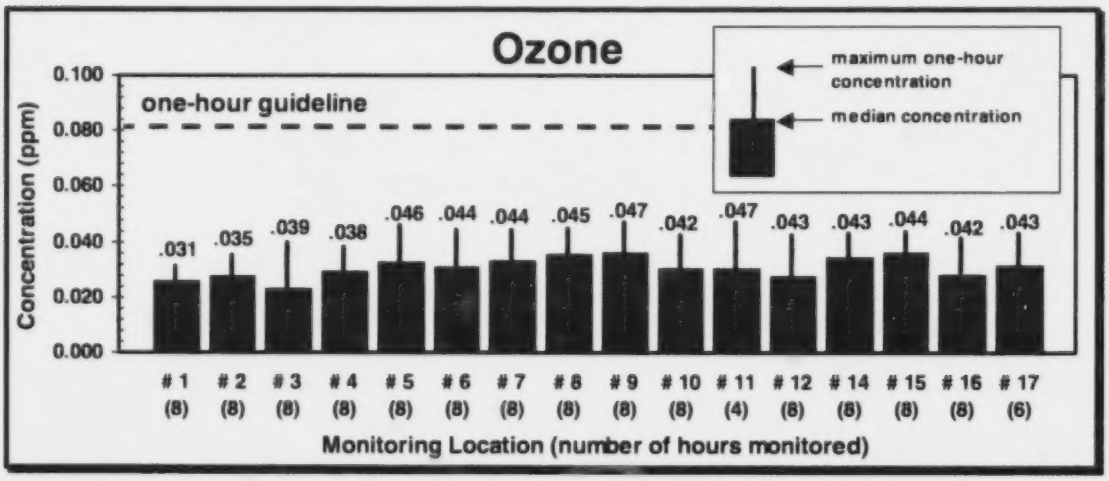
Ozone
maximum one-hour concentration
median concentration
one-hour guideline
Concentration (ppm)
0.100
0.080
0.060
0.040
0.020
0.000
.031 .035 .039 .038 .046 .044 .044 .045 .047 .042 .047 .043 .043 .044 .042 .043
# 1 (8) # 2 (8) # 3 (8) # 4 (8) # 5 (8) # 6 (8) # 7 (8) # 8 (8) # 9 (8) # 10 (8) # 11 (4) # 12 (8) # 14 (8) # 15 (8) # 16 (8) # 17 (6)
Monitoring Location (number of hours monitored)

**Figure 12 One-hour median and maximum concentrations for ozone.**

## Oxides of Nitrogen ($NO_2$, NO and $NO_x$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| $NO_2$ = 0.014 ppm | 0.212 ppm (based on odour perception) |
| NO = 0.038 ppm | no guideline |
| $NO_x$ = 0.047 ppm | no guideline |

*Oxides of nitrogen ($NO_x$) are the total of nitrogen dioxide ($NO_2$) and nitric oxide (NO). During high temperature combustion - as in the burning of natural gas, coal, oil and gasoline - atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless and odourless. Most NO in the ambient air is oxidized to form $NO_2$. $NO_2$ is a reddish-brown gas with a pungent odour. The major source of oxides of nitrogen in urban areas is vehicle exhaust emissions. Processes associated with the oil and gas industry also emit oxides of nitrogen into the atmosphere.*

$NO_2$ concentrations were well below Alberta's air quality guidelines in the Cold Lake area survey. The maximum $NO_2$ concentration (0.014 ppm) was recorded at Site #10 (Cold Lake Marina) on March 27, 2001 from 5:47 p.m. to 6:47 p.m. and at Site #6 (Imperial Oil Maskwa facility) on September 13, 2001 from 12:31 p.m. to 1:32 p.m. This $NO_2$ concentration is less than seven per cent of the one-hour guideline. Maximum one-hour $NO_2$ concentrations typically range from 0.013 to 0.080 ppm at rural locations and from 0.065 to 0.150 ppm at urban locations in Alberta.

The overall median $NO_2$ concentration at all sites in the Cold Lake area survey was 0.003 ppm. Median $NO_2$ levels at rural locations in Alberta generally range from 0.002 to 0.009 ppm. In Edmonton and Calgary, typical median $NO_2$ levels range from 0.013 to 0.025 ppm. The primary sources of oxides of nitrogen in the Cold Lake area are emissions from vehicles and sources related to the oil and gas industry.

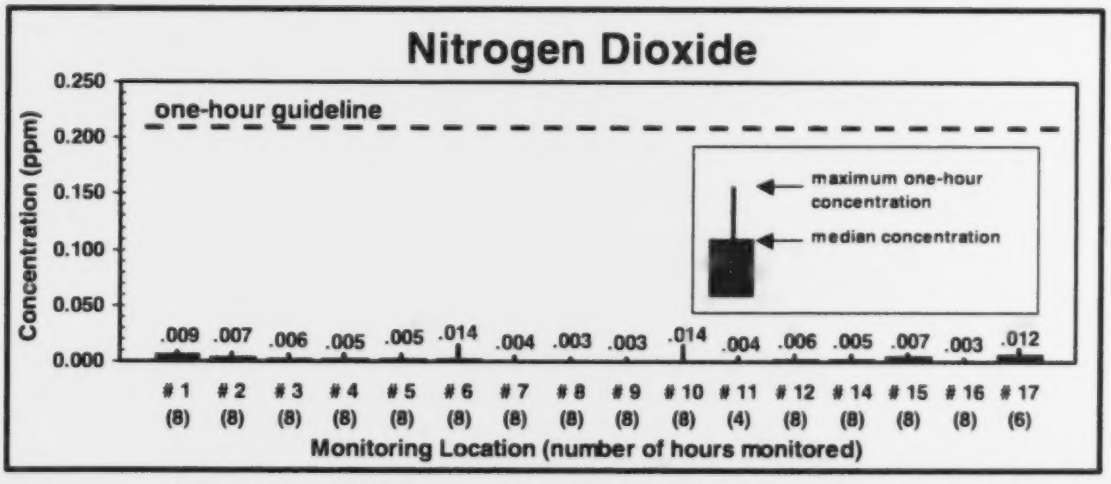
Nitrogen Dioxide
one-hour guideline
maximum one-hour concentration
median concentration
Concentration (ppm)
0.250
0.200
0.150
0.100
0.050
0.000
.009 .007 .006 .005 .005 .014 .004 .003 .003 .014 .004 .006 .005 .007 .003 .012
# 1 # 2 # 3 # 4 # 5 # 6 # 7 # 8 # 9 # 10 # 11 # 12 # 14 # 15 # 16 # 17
(8) (8) (8) (8) (8) (8) (8) (8) (8) (8) (4) (8) (8) (8) (8) (6)
Monitoring Location (number of hours monitored)

**Figure 13 One-hour median and maximum concentrations for nitrogen dioxide.**

## Carbon Monoxide (CO)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| 1.4 ppm | 13.0 ppm (based on the oxygen-carrying capacity of blood) |

*Carbon monoxide (CO) is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion. The major source of carbon monoxide at urban locations is vehicle exhaust emissions.*

CO values were low at all locations monitored in the Cold Lake area survey. The maximum one-hour concentration of 1.4 ppm was recorded at Site #15 (CNRL Elk Point facility) on September 14, 2000 from 11:01 a.m. to 12:02 p.m. This maximum one-hour concentration is eleven per cent of the one-hour guideline for CO. Maximum one-hour CO concentrations ranged from 0.7 to 2.8 ppm during other MAML monitoring surveys. Maximum CO levels in Edmonton and Calgary in 2001 ranged from 2.8 to 11.2 ppm.

The overall median concentration in the Cold Lake area survey was 0.2 ppm. Median CO concentrations at other mobile surveys in Alberta ranged from 0.2 to 0.4 ppm. At urban locations such as Edmonton and Calgary, median CO levels ranged from 0.3 to 0.5 ppm (based on 2001 data). The major source of CO at urban locations is vehicle exhaust emissions. CO is also be emitted by combustion processes associated with the oil and gas industry.

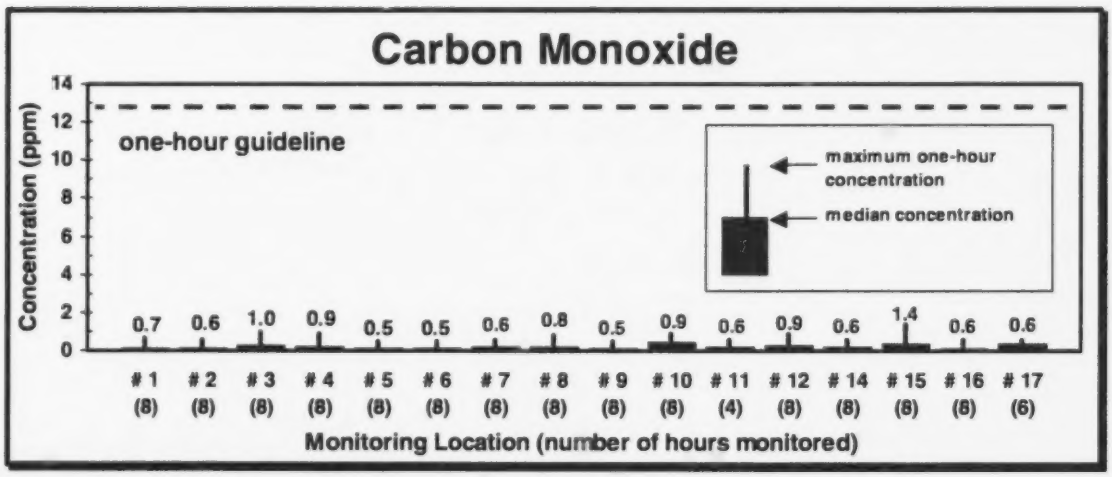


**Figure 14 One-hour median and maximum concentrations for carbon monoxide.**

## Polycyclic Aromatic Hydrocarbons (PAHs)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| 14 ng/m$^3$ | no guideline |

*Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are usually contained in soot and smoke. There are more than 100 different PAHs with varying levels of toxicity. They are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle exhaust emissions, wood smoke from fireplaces, smoke from forest fires and industrial facilities. PAHs occur in the atmosphere in the vapour phase or attached to dust particles. The PAH monitoring instrument aboard the MAML will analyze only particulate bound PAHs.*

The maximum one-hour average PAH concentration of 14 ng/m$^3$ (nanograms per cubic metre) was recorded at Site #2 (La Corey Intersection) on July 30, 2001 from 3:46 p.m. to 4:46 p.m. Maximum PAH levels measured during previous air quality surveys in Alberta ranged from 11 ng/m$^3$ in the Lethbridge area to 36 ng/m$^3$in the Bow Corridor. There is no one-hour guideline for PAHs.

The overall median PAH concentration in the Cold Lake area survey was 1 ng/m$^3$. Median PAH levels measured during previous air quality surveys in Alberta ranged from 1 ng/m$^3$ in the Whitecourt/Swan Hills area to 4 ng/m$^3$in the Bow Corridor.

PAHs are not routinely monitored on an hourly basis at permanent monitoring stations in Alberta.

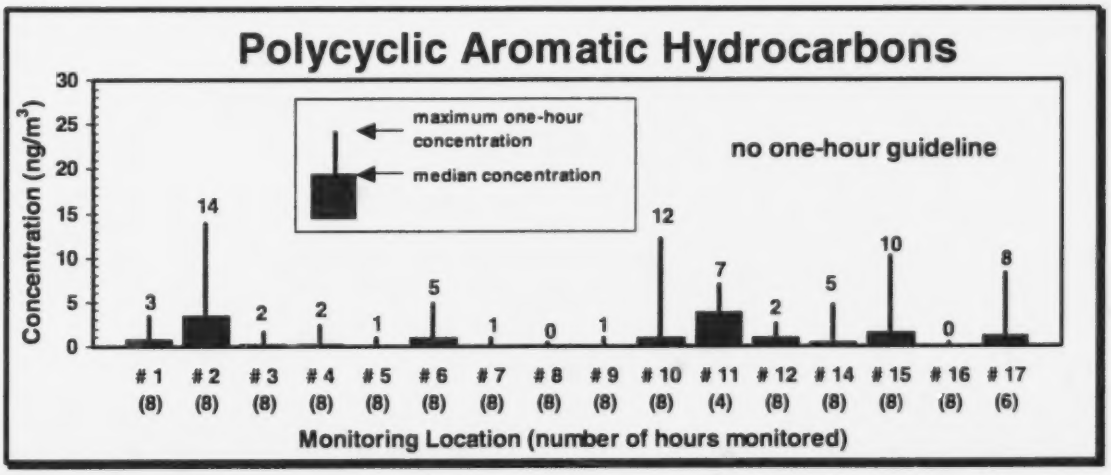


**Figure 15 One-hour median and maximum concentrations for polycyclic aromatic hydrocarbons.**

## Ammonia ($NH_3$)

| maximum one-hour concentration recorded during survey | one-hour guideline |
|---|---|
| 0.005 ppm | 2.0 ppm (based on odour perception) |

*Ammonia is a colourless gas with the well-known pungent odour found in household cleaners. $NH_3$ is produced both by natural and man-made sources. Some natural sources of $NH_3$ include the decay of plant material and animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of $NH_3$. The industry produces synthetic $NH_3$ for either direct application to soil as a fertilizer, or as a raw material for use in the production of other high nitrogen fertilizer products. The other major source of $NH_3$ is commercial feedlots, specifically from their large amounts of animal waste.*

Ammonia levels were very low in the Cold Lake area survey. The highest one-hour $NH_3$ concentration detected during the survey (0.005 ppm) was measured at Site #2 (La Corey Intersection) on July 30, 2001 from 3:46 p.m. to 4:46 p.m., and at Site #6 (Imperial Oil Maskwa facility) on September 13, 2001 from 12:31 p.m. to 1:32 p.m. This maximum $NH_3$ concentration measured at these two sites (0.005 ppm) is less than one per cent of the one-hour guideline (2.0 ppm). Maximum one-hour $NH_3$ concentrations from other MAML surveys ranged from 0.020 ppm (in the City of Lethbridge) to 1.364 ppm (in the area north of Lethbridge).

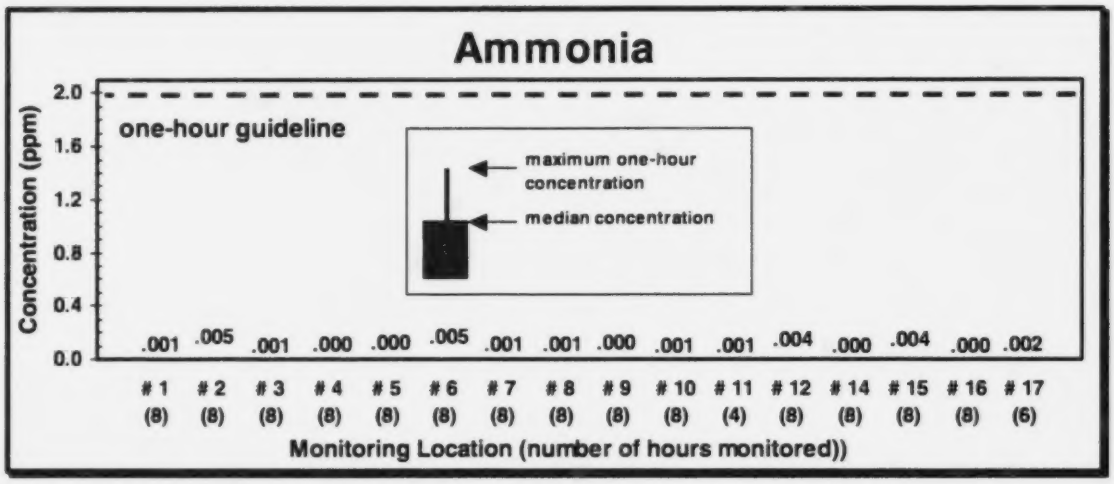


**Figure 16 One-hour median and maximum concentrations for ammonia.**

## Appendix – Data Collected by the Mobile Air Monitoring Laboratory

**Table A1 Median one-hour air pollutant concentrations at each monitoring site in the Cold Lake, Bonnyville and Elk Point areas survey.**

| Area (# of hours monitored) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ppm | ppm | ppm | | | ppm | ppm | | | ppm | ppm | ppm | ug/m$^3$ | | | ng/m$^3$ |
| Site # 1 (8) | 0.2 | 0.026 | 2.2 | 2.0 | 0.1 | 0.000 | 0.002 | 0.007 | 0.007 | 0.000 | 0.000 | 0.000 | 12 | 8 | 1 | 1 |
| Site # 2 (8) | 0.2 | 0.028 | 2.1 | 2.0 | 0.1 | 0.001 | 0.005 | 0.004 | 0.006 | 0.002 | 0.000 | 0.000 | 16 | 9 | 1 | 4 |
| Site # 3 (8) | 0.3 | 0.023 | 2.1 | 1.9 | 0.1 | 0.000 | 0.003 | 0.003 | 0.003 | 0.000 | 0.001 | 0.000 | 11 | 7 | 1 | 0 |
| Site # 4 (8) | 0.2 | 0.030 | 2.2 | 2.0 | 0.2 | 0.000 | 0.001 | 0.004 | 0.003 | 0.000 | 0.001 | 0.000 | 21 | 14 | 2 | 0 |
| Site # 5 (8) | 0.2 | 0.033 | 2.0 | 2.0 | 0.1 | 0.000 | 0.002 | 0.003 | 0.002 | 0.000 | 0.001 | 0.000 | 7 | 5 | 1 | 0 |
| Site # 6 (8) | 0.2 | 0.032 | 2.1 | 1.9 | 0.2 | 0.001 | 0.003 | 0.004 | 0.006 | 0.000 | 0.001 | 0.000 | 47 | 27 | 3 | 1 |
| Site # 7 (8) | 0.3 | 0.034 | 2.0 | 1.8 | 0.1 | 0.000 | 0.002 | 0.002 | 0.003 | 0.000 | 0.001 | 0.000 | 20 | 11 | 2 | 0 |
| Site # 8 (8) | 0.2 | 0.036 | 2.1 | 1.9 | 0.1 | 0.000 | 0.001 | 0.002 | 0.002 | 0.000 | 0.001 | 0.000 | 8 | 5 | 1 | 0 |
| Site # 9 (8) | 0.2 | 0.037 | 2.1 | 1.9 | 0.1 | 0.000 | 0.001 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 16 | 10 | 1 | 0 |
| Site # 10 (8) | 0.5 | 0.031 | 2.1 | 1.9 | 0.2 | 0.000 | 0.003 | 0.002 | 0.004 | 0.000 | 0.001 | 0.000 | 20 | 12 | 2 | 1 |
| Site # 11 (4) | 0.2 | 0.031 | 1.9 | 1.7 | 0.1 | 0.000 | 0.003 | 0.002 | 0.004 | 0.000 | 0.001 | 0.000 | 11 | 6 | 1 | 4 |
| Site # 12 (8) | 0.3 | 0.028 | 4.5 | 2.4 | 2.5 | 0.001 | 0.004 | 0.003 | 0.006 | 0.000 | 0.003 | 0.001 | 84 | 50 | 6 | 1 |
| Site # 14 (8) | 0.3 | 0.035 | 2.9 | 2.1 | 1.0 | 0.001 | 0.003 | 0.003 | 0.007 | 0.000 | 0.002 | 0.000 | 56 | 33 | 4 | 1 |
| Site # 15 (8) | 0.4 | 0.036 | 3.1 | 2.1 | 1.4 | 0.002 | 0.007 | 0.006 | 0.011 | 0.000 | 0.001 | 0.001 | 497 | 258 | 17 | 2 |
| Site # 16 (8) | 0.2 | 0.029 | 2.0 | 1.8 | 0.1 | 0.001 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 7 | 3 | 1 | 0 |
| Site # 17 (6) | 0.4 | 0.032 | 2.7 | 2.3 | 0.3 | 0.001 | 0.009 | 0.007 | 0.014 | 0.001 | 0.001 | 0.000 | 33 | 19 | 2 | 1 |
| **Overall Median** | **0.2** | **0.031** | **2.1** | **1.9** | **0.1** | **0.000** | **0.003** | **0.003** | **0.004** | **0.000** | **0.001** | **0.000** | **16** | **10** | **2** | **1** |

**Table A2 Maximum one-hour air pollutant concentrations at each monitoring site in the Cold Lake, Bonnyville and Elk Point areas survey.**

| Area (# of hours monitored) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ppm | ppm | ppm | | | ppm | ppm | | | ppm | ppm | ppm | ug/m$^3$ | | | ng/m$^3$ |
| Site # 1 (8) | 0.7 | 0.031 | 2.3 | 2.1 | 0.3 | 0.001 | 0.005 | 0.009 | 0.012 | 0.001 | 0.001 | 0.001 | 68 | 41 | 6 | 3 |
| Site # 2 (8) | 0.6 | 0.035 | 2.9 | 2.7 | 0.3 | 0.001 | 0.012 | 0.007 | 0.014 | **0.005** | 0.002 | 0.001 | 134 | 70 | 6 | **14** |
| Site # 3 (8) | 1.0 | 0.039 | 2.7 | 2.6 | 0.2 | 0.002 | 0.006 | 0.006 | 0.008 | 0.001 | 0.003 | 0.001 | 42 | 27 | 3 | 2 |
| Site # 4 (8) | 0.9 | 0.038 | 2.6 | 2.3 | 0.5 | 0.001 | 0.003 | 0.005 | 0.005 | 0.000 | 0.001 | 0.001 | 82 | 47 | 4 | 2 |
| Site # 5 (8) | 0.5 | 0.046 | 2.3 | 2.3 | 0.4 | 0.001 | 0.006 | 0.005 | 0.007 | 0.000 | 0.001 | 0.001 | 174 | 101 | 10 | 1 |
| Site # 6 (8) | 0.5 | 0.044 | 3.6 | 2.5 | 1.6 | **0.017** | **0.038** | **0.014** | **0.047** | **0.005** | 0.004 | 0.003 | 255 | 140 | 11 | 5 |
| Site # 7 (8) | 0.6 | 0.044 | 2.2 | 2.0 | 0.2 | 0.001 | 0.003 | 0.004 | 0.004 | 0.001 | 0.002 | 0.001 | 83 | 45 | 5 | 1 |
| Site # 8 (8) | 0.8 | 0.045 | 2.2 | 2.0 | 0.2 | 0.001 | 0.003 | 0.003 | 0.004 | 0.001 | 0.002 | 0.001 | 41 | 24 | 3 | 0 |
| Site # 9 (8) | 0.5 | **0.047** | 2.4 | 2.1 | 0.4 | 0.001 | 0.003 | 0.003 | 0.003 | 0.000 | 0.002 | 0.001 | 66 | 34 | 3 | 1 |
| Site # 10 (8) | 0.9 | 0.042 | 2.4 | 2.3 | 0.3 | 0.001 | 0.006 | 0.014 | 0.022 | 0.001 | 0.001 | 0.000 | 524 | 334 | 31 | 12 |
| Site # 11 (4) | 0.6 | **0.047** | 2.1 | 1.8 | 0.3 | 0.000 | 0.004 | 0.004 | 0.005 | 0.001 | 0.001 | 0.000 | 86 | 46 | 3 | 7 |
| Site # 12 (8) | 0.9 | 0.043 | **9.7** | **4.6** | **7.1** | 0.004 | 0.013 | 0.006 | 0.014 | 0.004 | **0.056** | **0.054** | 525 | 290 | 20 | 2 |
| Site # 14 (8) | 0.6 | 0.043 | 6.0 | 3.3 | 3.2 | 0.004 | 0.004 | 0.005 | 0.012 | 0.000 | 0.003 | 0.002 | 242 | 142 | 16 | 5 |
| Site # 15 (8) | **1.4** | 0.044 | 6.4 | 4.0 | 3.4 | 0.004 | 0.010 | 0.007 | 0.015 | 0.004 | 0.002 | 0.001 | 2052 | 1163 | 71 | 10 |
| Site # 16 (8) | 0.6 | 0.042 | 3.2 | 3.3 | 1.0 | 0.002 | 0.005 | 0.003 | 0.006 | 0.000 | 0.002 | 0.000 | 22 | 14 | 2 | 0 |
| Site # 17 (6) | 0.6 | 0.043 | 3.3 | 2.9 | 0.8 | 0.002 | 0.016 | 0.012 | 0.023 | 0.002 | 0.002 | 0.001 | **2281** | **1188** | **72** | 8 |
| **Overall Maximum** | **1.4** | **0.047** | **9.7** | **4.6** | **7.1** | **0.017** | **0.038** | **0.014** | **0.047** | **0.005** | **0.056** | **0.054** | **2281** | **1188** | **72** | **14** |
| **One-Hour Guideline** | **13.0** | **0.082** | **n/a** | | | **0.172** | **n/a** | **0.212** | **n/a** | **2.0** | **n/a** | **0.010** | **n/a** | | | |

## Table A3 Median one-hour air quality parameter concentrations in Alberta*.

| Air Quality Station | Station or Survey Type | Monitoring Period | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | $NO_2$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAHs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | $\mu g/m^3$ | $\mu g/m^3$ | $\mu g/m^3$ | $ng/m^3$ |
| Cold Lake/Bonnyville/Elk Point[1] | mobile survey | Mar. 2001 to Feb. 2002 | 0.2 | 0.031 | 2.1 | 1.9 | 0.1 | 0.000 | 0.003 | 0.000 | 0.001 | 0.000 | 16 | 10 | 2 | 1 |
| Whitecourt/Swan Hills/Shiningbank Lake[1] | mobile survey | Mar. 2001 to June 2001 | 0.2 | 0.027 | 2.3 | 2.0 | 0.3 | 0.004 | 0.005 | 0.001 | 0.001 | 0.000 | 47 | 29 | 4 | 1 |
| Bow Corridor[1] | mobile survey | Dec. 1999 to Sep. 2000 | 0.2 | 0.030 | 1.9 | 1.8 | 0.1 | 0.001 | 0.007 | 0.001 | 0.001 | 0.000 | 74 | 40 | 4 | 4 |
| County of Grande Prairie[1] | mobile survey | Dec. 1998 to Oct. 1999 | 0.2 | 0.036 | 2.0 | 1.7 | 0.2 | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 | 14 | 9 | 2 | 2 |
| Caroline/Sundre area[1] | mobile survey | Apr. 1997 to Apr. 1998 | 0.3 | 0.042 | 2.1 | 1.8 | 0.2 | 0.002 | 0.009 | n/a | 0.000 | 0.000 | 4 | 3 | 1 | n/a |
| City of Lethbridge[1] | mobile survey | Sep. 1998 to Jul. 1999 | 0.2 | 0.046 | 1.9 | 1.6 | 0.2 | 0.000 | 0.003 | 0.005 | 0.000 | 0.001 | 17 | 11 | 2 | 3 |
| City of Medicine Hat[1] | mobile survey | May 1998 to Jan. 1999 | 0.4 | 0.031 | 2.1 | 1.8 | 0.2 | 0.001 | 0.009 | 0.003 | 0.000 | 0.000 | 16 | 11 | 2 | 5 |
| Lethbridge area (Picture Butte, Sterling)[1] | mobile survey | Sep. 1998 to Jul. 1999 | 0.2 | 0.044 | 2.1 | 1.8 | 0.2 | 0.001 | 0.002 | 0.075 | 0.002 | 0.001 | 42 | 24 | 3 | 2 |
| Beaverlodge[2] | rural | Jan. to Dec. 2001 | n/a | 0.027 | n/a | n/a | n/a | 0.000 | 0.002 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Calgary Central[2] | urban | Jan. to Dec. 2001 | 0.5 | 0.014 | 2.0 | n/a | n/a | n/a | 0.025 | n/a | n/a | n/a | n/a | 19 | 8 | n/a |
| Calgary East[2] | urban | Jan. to Dec. 2001 | 0.5 | 0.015 | 2.1 | n/a | n/a | 0.002 | 0.022 | n/a | n/a | 0.001 | n/a | n/a | n/a | n/a |
| Calgary Northwest[2] | urban | Jan. to Dec. 2001 | 0.3 | 0.024 | 2.0 | n/a | n/a | n/a | 0.013 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Edmonton Central[2] | urban | Jan. to Dec. 2001 | 0.5 | 0.014 | 2.0 | n/a | n/a | n/a | 0.023 | n/a | n/a | n/a | n/a | n/a | 7 | n/a |
| Edmonton East[2] | urban | Jan. to Dec. 2001 | 0.3 | 0.021 | 2.2 | n/a | n/a | 0.002 | 0.015 | n/a | n/a | 0.000 | n/a | n/a | 8 | n/a |
| Edmonton Northwest[2] | urban | Jan. to Dec. 2001 | 0.5 | 0.016 | 2.2 | n/a | n/a | n/a | 0.020 | n/a | n/a | n/a | n/a | 19 | 10 | n/a |
| Fort Saskatchewan[2] | small urban | Jan. to Dec. 2001 | 0.3 | 0.021 | 1.9 | n/a | n/a | 0.001 | 0.009 | 0.002 | n/a | 0.000 | n/a | n/a | n/a | n/a |
| Red Deer[2] | small urban | Jan. to Dec. 2001 | 0.3 | 0.019 | 2.1 | n/a | n/a | 0.000 | 0.010 | n/a | n/a | 0.000 | n/a | n/a | 7 | n/a |
| Buffalo Viewpoint[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 1.9 | n/a | n/a | 0.000 | n/a | n/a | n/a | 0.000 | n/a | n/a | n/a | n/a |
| Fort Chipewyan[3] | rural | Jan. to Dec. 2001 | n/a | 0.029 | n/a | n/a | n/a | 0.000 | 0.000 | n/a | n/a | n/a | n/a | n/a | 4 | n/a |
| Fort McKay[3] | rural | Jan. to Dec. 2001 | n/a | 0.020 | 1.8 | n/a | n/a | 0.000 | 0.003 | n/a | 0.000 | n/a | n/a | n/a | 5 | n/a |
| Fort McMurray (Athabasca Valley)[3] | small urban | Jan. to Dec. 2001 | 0.2 | 0.016 | 1.9 | n/a | n/a | 0.000 | 0.007 | n/a | 0.000 | n/a | n/a | n/a | 5 | n/a |
| Fort McMurray (Patricia McInnes)[3] | small urban | Jan. to Dec. 2001 | n/a | 0.021 | 1.9 | n/a | n/a | 0.000 | 0.003 | n/a | 0.000 | n/a | n/a | n/a | 6 | n/a |
| Mannix[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 1.8 | n/a | n/a | 0.001 | n/a | n/a | n/a | 0.000 | n/a | n/a | n/a | n/a |
| Mildred Lake[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 2.0 | n/a | n/a | 0.001 | n/a | n/a | n/a | 0.000 | n/a | n/a | n/a | n/a |
| Carrot Creek[4] | rural | Jan. to Sept. 2001 | n/a | 0.034 | n/a | n/a | n/a | 0.001 | 0.004 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Hightower Ridge[4] | background | Jan. to Sept. 2001 | n/a | 0.048 | n/a | n/a | n/a | 0.000 | 0.000 | n/a | n/a | n/a | n/a | 5 | 1 | n/a |
| Steeper[4] | rural | Jan. to Sept. 2001 | n/a | 0.043 | n/a | n/a | n/a | 0.000 | 0.001 | n/a | n/a | n/a | n/a | 7 | n/a | n/a |
| Tomahawk[4] | rural | Jan. to Sept. 2001 | n/a | 0.034 | n/a | n/a | n/a | 0.001 | 0.003 | n/a | n/a | n/a | n/a | 11 | 2 | n/a |
| Violet Grove[4] | rural | Jan. to Sept. 2001 | n/a | 0.037 | 1.8 | n/a | n/a | 0.001 | 0.002 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sherwood Park[5] | small urban | Jan. to Dec. 2001 | n/a | n/a | 2.2 | n/a | n/a | 0.002 | n/a | n/a | n/a | 0.000 | n/a | n/a | n/a | n/a |
| Caroline[6] | rural | Aug. to Dec. 2001 | n/a | 0.035 | 2.0 | 1.9 | n/a | 0.001 | 0.002 | n/a | 0.000 | 0.000 | n/a | n/a | n/a | n/a |

1 Mobile survey conducted by Alberta Environment.
2 Station operated by Alberta Environment.
3 Station operated by the Wood Buffalo Environmental Association
4 Station operated by the West Central Airshed Society (data from Oct to Dec 2001 not available).
5 Station operated by the Strathcona Industrial Association.
6 Station operated by the Parkland Airshed Management Association.
n/a Parameter not monitored or data not available.
* Data is from the Alberta Ambient Air Data Management System (http://www.casadata.org).

## Table A4 Maximum one-hour air quality parameter concentrations in Alberta*.

| Air Quality Station | Station or Survey Type | Monitoring Period | CO ppm | $O_3$ ppm | THC ppm | $CH_4$ ppm | RHC ppm | $SO_2$ ppm | $NO_2$ ppm | $NH_3$ ppm | TRS ppm | $H_2S$ ppm | TSP $\mu g/m^3$ | $PM_{10}$ $\mu g/m^3$ | $PM_{2.5}$ $\mu g/m^3$ | PAHs $ng/m^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cold Lake/Bonnyville/Elk Point[1] | mobile survey | Mar. 2001 to Feb. 2002 | 1.4 | 0.047 | 9.7 | 4.6 | 7.1 | 0.017 | 0.014 | 0.005 | 0.056 | 0.054 | 2281 | 1188 | 72 | 14 |
| Whitecourt/Swan Hills/Shiningbank Lake[1] | mobile survey | Nov. 2000 to June 2001 | 0.7 | 0.054 | 4.3 | 2.5 | 2.5 | 0.046 | 0.030 | 0.013 | 0.005 | 0.003 | 946 | 441 | 43 | 113 |
| Bow Corridor[1] | mobile survey | Dec. 1999 to Sep. 2000 | 1.1 | 0.056 | 7.8 | 2.2 | 6.6 | 0.092 | 0.031 | 0.034 | 0.004 | 0.002 | 2082 | 1094 | 60 | 36 |
| County of Grande Prairie[1] | mobile survey | Dec. 1998 to Oct. 1999 | 1.0 | 0.064 | 32.4 | 6.4 | 29.4 | 0.043 | 0.061 | 0.030 | 0.010 | 0.009 | 2305 | 1287 | 101 | 35 |
| Caroline/Sundre area[1] | mobile survey | Apr. 1997 to Apr. 1998 | 0.9 | 0.059 | 2.9 | 2.6 | 0.7 | 0.043 | 0.040 | n/a | 0.008 | 0.008 | 52 | 43 | 17 | n/a |
| City of Lethbridge[1] | mobile survey | Sep. 1998 to Jul. 1999 | 2.4 | 0.062 | 2.2 | 1.9 | 0.4 | 0.007 | 0.016 | 0.020 | 0.001 | 0.003 | 405 | 363 | 294 | 21 |
| City of Medicine Hat[1] | mobile survey | May 1998 to Jan. 1999 | 2.8 | 0.062 | 2.6 | 2.3 | 0.4 | 0.029 | 0.080 | 0.027 | 0.001 | 0.004 | 213 | 135 | 12 | 35 |
| Lethbridge area (Picture Butte, Sterling)[1] | mobile survey | Sep. 1998 to Jul. 1999 | 1.2 | 0.059 | 9.5 | 7.1 | 1.6 | 0.004 | 0.013 | 1.364 | 0.054 | 0.054 | 490 | 298 | 32 | 11 |
| Beaverlodge[2] | rural | Jan. to Dec. 2001 | n/a | 0.068 | n/a | n/a | n/a | 0.030 | 0.028 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Calgary Central[2] | urban | Jan. to Dec. 2001 | 9.7 | 0.061 | 4.1 | n/a | n/a | n/a | 0.150 | n/a | n/a | n/a | n/a | 262 | 60 | n/a |
| Calgary East[2] | urban | Jan. to Dec. 2001 | 10.1 | 0.068 | 5.1 | n/a | n/a | 0.036 | 0.092 | n/a | n/a | 0.038 | n/a | n/a | n/a | n/a |
| Calgary Northwest[2] | urban | Jan. to Dec. 2001 | 6.3 | 0.073 | 3.5 | n/a | n/a | n/a | 0.065 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Edmonton Central[2] | urban | Jan. to Dec. 2001 | 5.4 | 0.062 | 4.8 | n/a | n/a | n/a | 0.086 | n/a | n/a | n/a | n/a | n/a | 275 | n/a |
| Edmonton East[2] | urban | Jan. to Dec. 2001 | 2.8 | 0.083 | 25.0 | n/a | n/a | 0.061 | 0.084 | n/a | n/a | 0.022 | n/a | n/a | 276 | n/a |
| Edmonton Northwest[2] | urban | Jan. to Dec. 2001 | 11.2 | 0.071 | 6.5 | n/a | n/a | n/a | 0.104 | n/a | n/a | n/a | n/a | 391 | 261 | n/a |
| Fort Saskatchewan[2] | small urban | Jan. to Dec. 2001 | 5.1 | 0.080 | 5.5 | n/a | n/a | 0.022 | 0.077 | 0.041 | n/a | 0.005 | n/a | n/a | 83 | n/a |
| Red Deer[2] | small urban | Jan. to Dec. 2001 | 5.0 | 0.073 | 6.4 | n/a | n/a | 0.011 | 0.051 | n/a | n/a | 0.009 | n/a | n/a | 162 | n/a |
| Buffalo Viewpoint[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 11.8 | n/a | n/a | 0.231 | n/a | n/a | n/a | 0.012 | n/a | n/a | n/a | n/a |
| Fort Chipewyan[3] | rural | Jan. to Dec. 2001 | n/a | 0.055 | n/a | n/a | n/a | 0.025 | 0.024 | n/a | n/a | n/a | n/a | n/a | 58 | n/a |
| Fort McKay[3] | rural | Jan. to Dec. 2001 | n/a | 0.058 | 4.2 | n/a | n/a | 0.158 | 0.042 | n/a | 0.018 | n/a | n/a | n/a | 86 | n/a |
| Fort McMurray (Athabasca Valley)[3] | small urban | Jan. to Dec. 2001 | 5.8 | 0.062 | 5.8 | n/a | n/a | 0.071 | 0.062 | n/a | 0.003 | n/a | n/a | n/a | 267 | n/a |
| Fort McMurray (Patricia McInnes)[3] | small urban | Jan. to Dec. 2001 | n/a | 0.074 | 6.3 | n/a | n/a | 0.042 | 0.073 | n/a | 0.011 | n/a | n/a | n/a | 101 | n/a |
| Mannix[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 6.6 | n/a | n/a | 0.211 | n/a | n/a | n/a | 0.027 | n/a | n/a | n/a | n/a |
| Mildred Lake[3] | industrial | Jan. to Dec. 2001 | n/a | n/a | 6.9 | n/a | n/a | 0.136 | n/a | n/a | n/a | 0.022 | n/a | n/a | n/a | n/a |
| Carrot Creek[4] | rural | Jan. to Sept. 2001 | n/a | 0.077 | n/a | n/a | n/a | 0.019 | 0.059 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Hightower Ridge[4] | background | Jan. to Sept. 2001 | n/a | 0.081 | n/a | n/a | n/a | 0.018 | 0.015 | n/a | n/a | n/a | n/a | 31 | 36 | n/a |
| Steeper[4] | rural | Jan. to Sept. 2001 | n/a | 0.075 | n/a | n/a | n/a | 0.006 | 0.019 | n/a | n/a | n/a | n/a | 193 | n/a | n/a |
| Tomahawk[4] | rural | Jan. to Sept. 2001 | n/a | 0.080 | n/a | n/a | n/a | 0.029 | 0.039 | n/a | n/a | n/a | n/a | 187 | 56 | n/a |
| Violet Grove[4] | rural | Jan. to Sept. 2001 | n/a | 0.070 | 8.4 | n/a | n/a | 0.015 | 0.036 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Sherwood Park[5] | small urban | Jan. to Dec. 2001 | n/a | n/a | 8.8 | n/a | n/a | 0.043 | n/a | n/a | n/a | 0.012 | n/a | n/a | n/a | n/a |
| Caroline[6] | rural | Jan. to Dec. 2001 | n/a | 0.074 | 7.2 | 3.5 | n/a | 0.017 | 0.031 | n/a | 0.017 | 0.017 | n/a | n/a | n/a | n/a |

1 Mobile survey conducted by Alberta Environment.
2 Station operated by Alberta Environment.
3 Station operated by the Wood Buffalo Environmental Association
4 Station operated by the West Central Airshed Society (data from Oct to Dec 2001 not available).
5 Station operated by the Strathcona Industrial Association.
6 Station operated by the Parkland Airshed Management Association.
n/a Parameter not monitored or data not available.
* Data is from the Alberta Ambient Air Data Management System (http://www.casadata.org).

## Table A5 One-hour average air pollutant concentrations in the Cold Lake, Bonnyville and Elk Point areas survey. (March 26 to 30, 2001).

| Date | Monitoring Location | Time (MST) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ppm | ppm | ppm | | | ppm | ppm | | | ppm | ppm | ppm | $ug/m^3$ | | | $ng/m^3$ |
| 26-Mar-01 | Site # 1 | 2:58 p.m. to 3:58 p.m. | 0.3 | 0.024 | no data | | | 0.001 | 0.001 | 0.002 | 0.004 | 0.000 | 0.000 | 0.001 | 68 | 41 | 6 | 1 |
| | Site # 2 | 4:42 p.m. to 5:42 p.m. | 0.2 | 0.024 | | | | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 19 | 13 | 3 | 0 |
| | Site # 3 | 6:32 p.m. to 7:32 p.m. | 0.5 | 0.020 | | | | 0.001 | 0.004 | 0.003 | 0.008 | 0.001 | 0.000 | 0.000 | 18 | 13 | 3 | 0 |
| 27-Mar-01 | Site # 5 | 9:30 a.m. to 10:30 a.m. | 0.2 | 0.040 | no data | | | 0.001 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 16 | 9 | 2 | 0 |
| | Site # 6 | 11:25 a.m. to 12:25 p.m. | 0.3 | 0.044 | | | | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 74 | 43 | 6 | 5 |
| | Site # 9 | 1:35 p.m. to 2:35 p.m. | 0.2 | 0.045 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 14 | 7 | 1 | 0 |
| | Site # 8 | 2:50 p.m. to 3:50 p.m. | 0.3 | 0.045 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 6 | 3 | 1 | 0 |
| | Site # 7 | 4:12 p.m. to 5:12 p.m. | 0.2 | 0.044 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 8 | 4 | 1 | 0 |
| | Site # 10 | 5:47 p.m. to 6:47 p.m. | 0.9 | 0.029 | | | | 0.000 | 0.006 | 0.014 | 0.022 | 0.000 | 0.000 | 0.000 | 524 | 334 | 31 | 12 |
| | Site # 4 | 7:43 p.m. to 8:43 p.m. | 0.3 | 0.038 | | | | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 11 | 7 | 1 | 2 |
| 28-Mar-01 | Site # 1 | 8:45 a.m. to 9:45 a.m. | 0.7 | 0.031 | no data | | | 0.001 | 0.001 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 34 | 23 | 3 | 0 |
| | Site # 4 | 10:11 a.m. to 11:11 a.m. | 0.9 | 0.028 | | | | 0.001 | 0.002 | 0.002 | 0.005 | 0.000 | 0.000 | 0.000 | 20 | 13 | 2 | 0 |
| | Site # 2 | 11:58 a.m. to 12:58 p.m. | 0.4 | 0.035 | | | | 0.001 | 0.001 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 12 | 9 | 2 | 0 |
| | Site # 3 | 1:06 p.m. to 2:06 p.m. | 0.4 | 0.039 | | | | 0.000 | 0.001 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 16 | 10 | 2 | 0 |
| | Site # 12 | 2:57 p.m. to 3:57 p.m. | 0.5 | 0.043 | | | | 0.001 | 0.001 | 0.002 | 0.004 | 0.000 | 0.000 | 0.000 | 143 | 83 | 7 | 1 |
| | | 3:58 p.m. to 4:57 p.m. | 0.9 | 0.039 | | | | 0.002 | 0.003 | 0.006 | 0.009 | 0.004 | 0.001 | 0.001 | 305 | 162 | 13 | 2 |
| | Site # 11 | 5:06 p.m. to 6:06 p.m. | 0.3 | 0.047 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 9 | 4 | 1 | 7 |
| 29-Mar-01 | Site # 5 | 8:46 a.m. to 9:46 a.m. | 0.1 | 0.040 | no data | | | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 4 | 2 | 0 | 0 |
| | Site # 6 | 10:09 a.m. to 11:09 a.m. | 0.1 | 0.041 | | | | 0.000 | 0.002 | 0.001 | 0.003 | 0.001 | 0.000 | 0.000 | 13 | 8 | 1 | 1 |
| | Site # 9 | 11:45 a.m. to 12:45 p.m. | 0.1 | 0.042 | | | | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 21 | 13 | 2 | 0 |
| | Site # 8 | 12:57 p.m. to 1:56 p.m. | 0.1 | 0.043 | | | | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 13 | 7 | 2 | 0 |
| | Site # 7 | 2:10 p.m. to 3:10 p.m. | 0.1 | 0.044 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 18 | 9 | 1 | 0 |
| | Site # 10 | 3:32 p.m. to 4:32 p.m. | 0.1 | 0.042 | | | | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 36 | 21 | 2 | 1 |
| 30-Mar-01 | Site # 14 | 9:24 a.m. to 10:23 a.m. | 0.3 | 0.038 | no data | | | 0.002 | 0.003 | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 177 | 103 | 12 | 1 |
| | | 10:24 a.m. to 11:25 a.m. | 0.3 | 0.037 | | | | 0.002 | 0.004 | 0.005 | 0.012 | 0.000 | 0.000 | 0.000 | 242 | 142 | 16 | 2 |
| | Site # 16 | 12:07 p.m. to 1:06 p.m. | 0.2 | 0.041 | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 9 | 4 | 1 | 0 |
| | | 1:07 p.m. to 2:08 p.m. | 0.3 | 0.042 | | | | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 7 | 3 | 1 | 0 |
| | Site # 15 | 3:20 p.m. to 4:19 p.m. | 0.4 | 0.039 | | | | 0.002 | 0.004 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 705 | 432 | 50 | 2 |
| | | 4:20 p.m. to 5:21 p.m. | 0.4 | 0.036 | | | | 0.002 | 0.007 | 0.006 | 0.015 | 0.000 | 0.000 | 0.000 | 741 | 487 | 56 | 4 |
| **one-hour guideline** | | | **13.0** | **0.082** | **n/a** | | | **0.172** | **n/a** | **0.212** | **n/a** | **2.0** | **n/a** | **0.010** | **n/a** | | | |

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.
$ng/m^3$ - nanograms per cubic metre of air
$ug/m^3$ - micrograms per cubic metre of air
ppm - parts per million

**List of Air Quality Parameters**

CO - carbon monoxide
$O_3$ - ozone
THC - total hydrocarbons
$CH_4$ - methane
RHC - reactive hydrocarbons
$SO_2$ - sulphur dioxide
NO - nitric oxide
$NO_2$ - nitrogen dioxide
$NO_x$ - total oxides of nitrogen
$NH_3$ - ammonia
TRS - total reduced sulphur
$H_2S$ - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
$PM_{10}$ - inhalable particulates
$PM_{2.5}$ - respirable particulates

## Table A6 One-hour average air pollutant concentrations in the Cold Lake, Bonnyville and Elk Point areas survey. (July 30 to August 3, 2001).

| Date | Monitoring Location | Time (MST) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ppm | ppm | ppm | | | ppm | ppm | | | ppm | ppm | ppm | $ug/m^3$ | | | $ng/m^3$ |
| 30-Jul-01 | Site # 16 | 11:29 a.m. to 12:28 p.m. | 0.2 | 0.021 | 2.0 | 1.8 | 0.2 | 0.001 | 0.002 | 0.003 | 0.002 | 0.000 | 0.002 | 0.000 | 22 | 14 | 2 | 0 |
| | | 12:29 p.m. to 1:30 p.m. | 0.1 | 0.021 | 2.0 | 1.8 | 0.2 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 20 | 13 | 2 | 0 |
| | Site # 3 | 2:31 p.m. to 3:31 p.m. | 0.2 | 0.024 | 2.1 | 1.9 | 0.2 | 0.002 | 0.003 | 0.004 | 0.002 | 0.000 | 0.003 | 0.000 | 14 | 10 | 1 | 0 |
| | Site # 2 | 3:46 p.m. to 4:46 p.m. | 0.2 | 0.027 | 2.2 | 1.9 | 0.3 | 0.001 | 0.007 | 0.005 | 0.007 | 0.005 | 0.001 | 0.000 | 40 | 23 | 2 | 14 |
| | Site # 1 | 5:03 p.m. to 6:02 p.m. | 0.1 | 0.029 | 2.2 | 2.0 | 0.3 | 0.000 | 0.004 | 0.006 | 0.007 | 0.001 | 0.001 | 0.001 | 21 | 13 | 2 | 1 |
| | | 6:03 p.m. to 7:03 p.m. | 0.1 | 0.024 | 2.2 | 1.9 | 0.2 | 0.000 | 0.003 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 18 | 12 | 2 | 0 |
| 31-Jul-01 | Site # 5 | 7:29 a.m. to 8:30 a.m. | 0.3 | 0.015 | 2.0 | 2.0 | 0.1 | 0.000 | 0.002 | 0.003 | 0.002 | 0.000 | 0.000 | 0.000 | 18 | 13 | 2 | 0 |
| | Site # 6 | 9:03 a.m. to 10:04 a.m. | 0.2 | 0.027 | 1.9 | 1.8 | 0.1 | 0.001 | 0.003 | 0.005 | 0.006 | 0.000 | 0.000 | 0.000 | 107 | 55 | 4 | 1 |
| | Site # 9 | 11:02 a.m. to 12:03 p.m. | 0.3 | 0.029 | 1.9 | 1.8 | 0.1 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 66 | 26 | 2 | 0 |
| | Site # 8 | 12:14 p.m. to 1:15 p.m. | 0.3 | 0.029 | 1.9 | 1.8 | 0.1 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 10 | 7 | 1 | 0 |
| | Site # 7A | 1:27 p.m. to 2:28 p.m. | 0.6 | 0.025 | 1.9 | 1.8 | 0.2 | 0.001 | 0.003 | 0.004 | 0.004 | 0.000 | 0.001 | 0.000 | 21 | 13 | 1 | 1 |
| | Site # 10 | 3:03 p.m. to 4:04 p.m. | 0.7 | 0.030 | 2.1 | 1.9 | 0.2 | 0.001 | 0.003 | 0.004 | 0.005 | 0.001 | 0.001 | 0.000 | 31 | 17 | 2 | 1 |
| | | 4:04 p.m. to 5:04 p.m. | 0.5 | 0.031 | 2.0 | 1.9 | 0.1 | 0.001 | 0.003 | 0.004 | 0.003 | 0.001 | 0.001 | 0.000 | 27 | 15 | 2 | 1 |
| | Site # 4 | 5:42 p.m. to 6:43 p.m. | 0.3 | 0.030 | 2.3 | 2.2 | 0.2 | 0.000 | 0.003 | 0.004 | 0.005 | 0.000 | 0.000 | 0.000 | 36 | 21 | 2 | 0 |
| | | 6:43 p.m. to 7:43 p.m. | 0.4 | 0.029 | 2.3 | 2.3 | 0.2 | 0.000 | 0.001 | 0.004 | 0.002 | 0.000 | 0.001 | 0.000 | 82 | 47 | 4 | 0 |
| 1-Aug-01 | Site # 12 | 7:32 a.m. to 8:33 a.m. | 0.6 | 0.018 | 6.1 | 2.8 | 3.8 | 0.001 | 0.007 | 0.004 | 0.009 | 0.000 | 0.005 | 0.005 | 525 | 290 | 20 | 1 |
| | | 8:33 a.m. to 9:33 a.m. | 0.6 | 0.023 | 2.5 | 1.9 | 0.6 | 0.000 | 0.004 | 0.002 | 0.004 | 0.000 | 0.001 | 0.001 | 453 | 248 | 17 | 0 |
| | Site # 11 | 9:44 a.m. to 10:45 a.m. | 0.6 | 0.026 | 2.1 | 1.8 | 0.3 | 0.000 | 0.004 | 0.001 | 0.004 | 0.000 | 0.001 | 0.000 | 86 | 46 | 3 | 1 |
| | Site # 14 | 12:44 p.m. to 1:45 p.m. | 0.6 | 0.043 | 3.6 | 1.7 | 2.3 | 0.004 | 0.003 | 0.002 | 0.005 | 0.000 | 0.003 | 0.002 | 54 | 27 | 2 | 0 |
| | Site # 17 | 2:16 p.m. to 3:17 p.m. | 0.5 | 0.043 | 2.3 | 2.0 | 0.3 | 0.002 | 0.002 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 27 | 15 | 1 | 0 |
| | Site # 15 | 4:11 p.m. to 5:12 p.m. | 1.2 | 0.040 | 6.4 | 4.0 | 3.4 | 0.002 | 0.005 | 0.005 | 0.010 | 0.000 | 0.001 | 0.001 | 514 | 270 | 18 | 10 |
| 2-Aug-01 | Site # 3 | 7:24 a.m. to 8:25 a.m. | 0.6 | 0.022 | 2.7 | 2.6 | 0.1 | 0.000 | 0.006 | 0.003 | 0.008 | 0.000 | 0.002 | 0.001 | 42 | 27 | 3 | 0 |
| | Site # 2 | 8:34 a.m. to 9:35 a.m. | 0.6 | 0.028 | 2.9 | 2.7 | 0.2 | 0.001 | 0.012 | 0.004 | 0.014 | 0.000 | 0.002 | 0.001 | 134 | 70 | 6 | 10 |
| | Site # 7 | 10:22 a.m. to 11:23 a.m. | 0.6 | 0.036 | 2.2 | 2.0 | 0.2 | 0.000 | 0.003 | 0.002 | 0.004 | 0.000 | 0.001 | 0.001 | 42 | 25 | 3 | 0 |
| | Site # 8 | 11:53 a.m. to 12:54 p.m. | 0.5 | 0.044 | 2.1 | 2.0 | 0.2 | 0.000 | 0.002 | 0.001 | 0.002 | 0.000 | 0.002 | 0.001 | 41 | 24 | 3 | 0 |
| | Site # 9 | 1:13 p.m. to 2:14 p.m. | 0.5 | 0.047 | 2.4 | 2.0 | 0.4 | 0.000 | 0.003 | 0.001 | 0.003 | 0.000 | 0.002 | 0.001 | 56 | 34 | 3 | 0 |
| | Site # 6 | 2:52 p.m. to 3:53 p.m. | 0.5 | 0.044 | 2.1 | 1.8 | 0.4 | 0.013 | 0.011 | 0.004 | 0.013 | 0.000 | 0.003 | 0.002 | 255 | 140 | 11 | 2 |
| | Site # 5 | 4:12 p.m. to 5:13 p.m. | 0.5 | 0.046 | 2.0 | 1.7 | 0.4 | 0.000 | 0.002 | 0.001 | 0.002 | 0.000 | 0.001 | 0.001 | 174 | 101 | 10 | 0 |
| 3-Aug-01 | Site # 14 | 7:39 a.m. to 8:40 a.m. | 0.6 | 0.033 | 6.0 | 3.3 | 3.2 | 0.001 | 0.003 | 0.005 | 0.006 | 0.000 | 0.002 | 0.002 | 71 | 41 | 4 | 0 |
| | Site # 17 | 8:57 a.m. to 9:58 a.m. | 0.6 | 0.035 | 3.0 | 2.3 | 0.8 | 0.001 | 0.016 | 0.008 | 0.019 | 0.002 | 0.001 | 0.001 | 2281 | 1188 | 72 | 2 |
| | Site # 15 | 10:37 a.m. to 11:38 a.m. | 0.7 | 0.044 | 3.6 | 2.3 | 1.6 | 0.000 | 0.006 | 0.007 | 0.009 | 0.000 | 0.001 | 0.001 | 2052 | 1163 | 71 | 7 |
| **one-hour guideline** | | | **13.0** | **0.082** | **n/a** | | | **0.172** | **n/a** | **0.212** | **n/a** | **2.0** | **n/a** | **0.010** | **n/a** | | | |

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

$ng/m^3$ - nanograms per cubic metre of air
$ug/m^3$ - micrograms per cubic metre of air
ppm - parts per million

**List of Air Quality Parameters**

CO - carbon monoxide
$O_3$ - ozone
THC - total hydrocarbons
$CH_4$ - methane
RHC - reactive hydrocarbons
$SO_2$ - sulphur dioxide
NO - nitric oxide
$NO_2$ - nitrogen dioxide
$NO_x$ - total oxides of nitrogen
$NH_3$ - ammonia
TRS - total reduced sulphur
$H_2S$ - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
$PM_{10}$ - inhalable particulates
$PM_{2.5}$ - respirable particulates

## Table A7 One-hour average air pollutant concentrations in the Cold Lake, Bonnyville and Elk Point areas survey. (September 10 to 14, 2001).

| Date | Monitoring Location | Time (MST) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ppm | ppm | ppm | | | ppm | ppm | | | ppm | ppm | ppm | ug/m$^3$ | | | ng/m$^3$ |
| 10-Sep-01 | Site # 16 | 11:20 a.m. to 12:21 p.m. | 0.6 | 0.019 | 1.8 | 1.8 | 0.0 | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.001 | 0.000 | 6 | 3 | 0 | 0 |
| | | 12:31 p.m. to 1:32 p.m. | 0.2 | 0.019 | 3.2 | 3.3 | 1.0 | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 7 | 3 | 0 | 0 |
| | Site # 3 | 2:21 p.m. to 3:22 p.m. | 1.0 | 0.016 | 1.9 | 1.9 | 0.1 | 0.000 | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 9 | 5 | 0 | 0 |
| | Site # 2 | 3:28 p.m. to 4:29 p.m. | 0.2 | 0.015 | 2.0 | 2.0 | 0.1 | 0.000 | 0.004 | 0.004 | 0.005 | 0.001 | 0.000 | 0.000 | 16 | 9 | 1 | 2 |
| | | 4:28 p.m. to 5:29 p.m. | 0.2 | 0.014 | 2.0 | 1.9 | 0.1 | 0.000 | 0.004 | 0.003 | 0.004 | 0.002 | 0.000 | 0.000 | 15 | 9 | 1 | 5 |
| | Site # 1 | 5:50 p.m. to 6:51 p.m. | 0.2 | 0.011 | 2.0 | 1.9 | 0.1 | 0.000 | 0.003 | 0.007 | 0.007 | 0.000 | 0.000 | 0.000 | 5 | 4 | 1 | 2 |
| | | 6:50 p.m. to 7:51 p.m. | 0.3 | 0.008 | 2.0 | 2.0 | 0.1 | 0.000 | 0.005 | 0.009 | 0.012 | 0.000 | 0.000 | 0.000 | 6 | 4 | 1 | 3 |
| 11-Sep-01 | Site # 5 | 8:02 a.m. to 9:03 a.m. | 0.1 | 0.012 | 1.9 | 1.9 | 0.1 | 0.000 | 0.006 | 0.003 | 0.007 | 0.000 | 0.001 | 0.000 | 5 | 4 | 1 | 1 |
| | | 9:02 a.m. to 10:03 a.m. | 0.0 | 0.015 | 1.8 | 1.8 | 0.1 | 0.000 | 0.005 | 0.003 | 0.005 | 0.000 | 0.001 | 0.000 | 5 | 3 | 1 | 0 |
| | Site # 6 | 10:45 a.m. to 11:46 a.m. | 0.2 | 0.016 | 1.9 | 1.7 | 0.3 | 0.001 | 0.003 | 0.002 | 0.005 | 0.000 | 0.002 | 0.000 | 20 | 11 | 1 | 1 |
| | Site # 9 | 12:22 p.m. to 1:23 p.m. | 0.0 | 0.018 | 1.8 | 1.7 | 0.1 | 0.000 | 0.003 | 0.002 | 0.003 | 0.000 | 0.001 | 0.000 | 5 | 3 | 1 | 0 |
| | Site # 8 | 1:35 p.m. to 2:36 p.m. | 0.0 | 0.019 | 1.9 | 1.8 | 0.1 | 0.001 | 0.003 | 0.001 | 0.003 | 0.000 | 0.002 | 0.000 | 3 | 2 | 0 | 0 |
| | Site # 7 | 2:56 p.m. to 3:57 p.m. | 0.1 | 0.017 | 1.8 | 1.7 | 0.1 | 0.001 | 0.003 | 0.002 | 0.004 | 0.000 | 0.002 | 0.000 | 7 | 4 | 1 | 0 |
| | Site # 10 | 4:28 p.m. to 5:29 p.m. | 0.5 | 0.018 | 1.9 | 1.8 | 0.2 | 0.000 | 0.003 | 0.001 | 0.004 | 0.000 | 0.001 | 0.000 | 9 | 6 | 1 | 1 |
| | | 5:28 p.m. to 6:29 p.m. | 0.6 | 0.016 | 1.9 | 1.7 | 0.3 | 0.000 | 0.003 | 0.002 | 0.005 | 0.000 | 0.001 | 0.000 | 13 | 8 | 1 | 2 |
| 12-Sep-01 | Site # 12 | 8:14 a.m. to 9:15 a.m. | 0.0 | 0.011 | 9.7 | 4.6 | 7.1 | 0.004 | 0.013 | 0.004 | 0.014 | 0.001 | 0.056 | 0.054 | 26 | 17 | 4 | 2 |
| | | 9:14 a.m. to 10:15 a.m. | 0.0 | 0.014 | 7.0 | 3.9 | 4.7 | 0.003 | 0.009 | 0.003 | 0.009 | 0.001 | 0.030 | 0.029 | 13 | 9 | 2 | 1 |
| | Site # 11 | 10:22 a.m. to 11:23 a.m. | 0.0 | 0.018 | 1.7 | 1.6 | 0.1 | 0.000 | 0.004 | 0.004 | 0.005 | 0.000 | 0.001 | 0.000 | 13 | 8 | 1 | 2 |
| | Site # 3 | 12:00 p.m. to 1:01 p.m. | 0.0 | 0.021 | 2.0 | 1.8 | 0.2 | 0.001 | 0.003 | 0.003 | 0.003 | 0.000 | 0.001 | 0.000 | 9 | 5 | 1 | 2 |
| | Site # 15 | 2:05 p.m. to 3:06 p.m. | 0.0 | 0.027 | 2.5 | 1.7 | 1.1 | 0.002 | 0.008 | 0.007 | 0.011 | 0.004 | 0.001 | 0.001 | 479 | 245 | 15 | 1 |
| | Site # 17 | 3:38 p.m. to 4:39 p.m. | 0.0 | 0.030 | 2.1 | 1.9 | 0.2 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 39 | 23 | 2 | 0 |
| | Site # 14 | 5:12 p.m. to 6:13 p.m. | 0.0 | 0.030 | 2.2 | 1.7 | 0.6 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 58 | 35 | 4 | 0 |
| | Site # 4 | 6:58 p.m. to 7:59 p.m. | 0.0 | 0.013 | 2.0 | 1.9 | 0.2 | 0.001 | 0.000 | 0.003 | 0.002 | 0.000 | 0.001 | 0.000 | 23 | 15 | 2 | 1 |
| | | 7:58 p.m. to 8:59 p.m. | 0.0 | 0.012 | 2.6 | 2.1 | 0.5 | 0.000 | 0.000 | 0.005 | 0.004 | 0.000 | 0.001 | 0.000 | 30 | 17 | 2 | 1 |
| 13-Sep-01 | Site # 7 | 8:40 a.m. to 9:41 a.m. | 0.3 | 0.013 | 1.9 | 1.9 | 0.1 | 0.000 | 0.003 | 0.002 | 0.004 | 0.000 | 0.001 | 0.000 | 11 | 8 | 2 | 1 |
| | Site # 8 | 9:51 a.m. to 10:52 a.m. | 0.8 | 0.014 | 2.0 | 1.9 | 0.1 | 0.000 | 0.003 | 0.002 | 0.004 | 0.000 | 0.002 | 0.000 | 11 | 8 | 2 | 0 |
| | Site # 9 | 11:01 a.m. to 12:02 p.m. | 0.2 | 0.016 | 2.0 | 1.9 | 0.1 | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 19 | 13 | 2 | 0 |
| | Site # 6 | 12:31 p.m. to 1:32 p.m. | 0.2 | 0.013 | 3.6 | 2.5 | 1.6 | 0.017 | 0.038 | 0.014 | 0.047 | 0.005 | 0.004 | 0.003 | 91 | 51 | 5 | 3 |
| 14-Sep-01 | Site # 14 | 7:51 a.m. to 8:52 a.m. | 0.0 | 0.015 | 2.4 | 2.2 | 0.2 | 0.000 | 0.004 | 0.003 | 0.006 | 0.000 | 0.000 | 0.000 | 50 | 30 | 4 | 1 |
| | Site # 17 | 9:20 a.m. to 10:21 a.m. | 0.6 | 0.016 | 2.9 | 2.6 | 0.3 | 0.001 | 0.007 | 0.006 | 0.009 | 0.001 | 0.000 | 0.000 | 66 | 39 | 5 | 1 |
| | Site # 15 | 11:01 a.m. to 12:02 p.m. | 1.4 | 0.029 | 2.5 | 1.7 | 1.0 | 0.004 | 0.008 | 0.007 | 0.013 | 0.002 | 0.001 | 0.001 | 157 | 85 | 7 | 1 |
| **one-hour guideline** | | | **13.0** | **0.082** | **n/a** | | | **0.172** | **n/a** | **0.212** | **n/a** | **2.0** | **n/a** | **0.010** | **n/a** | | | |

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

ng/m$^3$ - nanograms per cubic metre of air
ug/m$^3$ - micrograms per cubic metre of air
ppm - parts per million

**List of Air Quality Parameters**

CO - carbon monoxide
$O_3$ - ozone
THC - total hydrocarbons
$CH_4$ - methane
RHC - reactive hydrocarbons
$SO_2$ - sulphur dioxide
NO - nitric oxide
$NO_2$ - nitrogen dioxide
$NO_x$ - total oxides of nitrogen
$NH_3$ - ammonia
TRS - total reduced sulphur
$H_2S$ - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
$PM_{10}$ - inhalable particulates
$PM_{2.5}$ - respirable particulates

## Table A8 One-hour average air pollutant concentrations in the Cold Lake, Bonnyville and Elk Point areas survey. (February 11 to 15, 2002).

| Date | Monitoring Location | Time (MST) | CO | $O_3$ | THC | $CH_4$ | RHC | $SO_2$ | NO | $NO_2$ | $NO_x$ | $NH_3$ | TRS | $H_2S$ | TSP | $PM_{10}$ | $PM_{2.5}$ | PAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ppm | ppm | | ppm | | ppm | | ppm | | ppm | ppm | ppm | | ug/m$^3$ | | ng/m$^3$ |
| 11-Feb-02 | Site # 16 | 1:00 p.m. to 2:00 p.m. | 0.0 | 0.036 | 1.7 | 1.8 | 0.0 | 0.001 | 0.005 | 0.003 | 0.006 | 0.000 | | 0.000 | 5 | 2 | 1 | 0 |
| | | 2:01 p.m. to 3:01 p.m. | 0.2 | 0.036 | 1.9 | 1.9 | 0.1 | 0.001 | 0.004 | 0.002 | 0.005 | 0.000 | | 0.000 | 4 | 2 | 1 | 0 |
| | Site # 3 | 4:20 p.m. to 5:20 p.m. | 0.1 | 0.036 | 1.9 | 1.9 | 0.1 | 0.000 | 0.002 | 0.001 | 0.003 | 0.000 | | 0.000 | 2 | 1 | 1 | 0 |
| | Site # 2 | 5:30 p.m. to 6:30 p.m. | 0.2 | 0.035 | 2.1 | 2.0 | 0.1 | 0.001 | 0.009 | 0.007 | 0.013 | 0.003 | no data | 0.000 | 3 | 2 | 1 | 7 |
| | | 6:31 p.m. to 7:31 p.m. | 0.2 | 0.032 | 2.3 | 2.2 | 0.0 | 0.000 | 0.006 | 0.006 | 0.010 | 0.003 | | 0.000 | 4 | 3 | 1 | 3 |
| | Site # 1 | 7:51 p.m. to 8:51 p.m. | 0.2 | 0.030 | 2.3 | 2.1 | 0.1 | 0.000 | 0.002 | 0.009 | 0.010 | 0.000 | | 0.000 | 2 | 2 | 1 | 3 |
| | | 8:52 p.m. to 9:52 p.m. | 0.2 | 0.029 | 2.2 | 2.1 | 0.0 | 0.000 | 0.001 | 0.009 | 0.009 | 0.000 | | 0.000 | 3 | 2 | 0 | 1 |
| 12-Feb-02 | Site # 5 | 8:40 a.m. to 9:40 a.m. | 0.2 | 0.03 | 2.3 | 2.1 | 0.0 | 0.000 | 0.001 | 0.005 | 0.003 | 0.000 | | 0.001 | 2 | 2 | 1 | 0 |
| | Site # 6 | 10:12 a.m. to 11:12 a.m. | 0.2 | 0.032 | 2.2 | 1.9 | 0.1 | 0.001 | 0.002 | 0.003 | 0.003 | 0.002 | | 0.000 | 12 | 10 | 2 | 1 |
| | Site # 7A | 12:02 p.m. to 1:02 p.m. | 0.2 | 0.033 | 2.1 | 1.8 | 0.0 | 0.000 | 0.001 | 0.002 | 0.001 | 0.001 | | 0.000 | 83 | 45 | 5 | 0 |
| | | 1:02 p.m. to 2:02 p.m. | 0.3 | 0.034 | 2.1 | 1.8 | 0.0 | 0.001 | 0.001 | 0.003 | 0.002 | 0.000 | | 0.000 | 43 | 20 | 3 | 1 |
| | Site # 8 | 2:10 p.m. to 3:10 p.m. | 0.2 | 0.036 | 2.2 | 1.9 | 0.0 | 0.001 | 0.001 | 0.002 | 0.001 | 0.000 | no data | 0.000 | 2 | 1 | 0 | 0 |
| | | 3:10 p.m. to 4:10 p.m. | 0.2 | 0.036 | 2.1 | 1.9 | 0.0 | 0.001 | 0.001 | 0.003 | 0.002 | 0.000 | | 0.000 | 1 | 1 | 0 | 0 |
| | Site # 9 | 4:22 p.m. to 5:22 p.m. | 0.2 | 0.035 | 2.1 | 1.8 | 0.1 | 0.000 | 0.001 | 0.003 | 0.003 | 0.000 | | 0.000 | 7 | 5 | 1 | 1 |
| | Site # 4 | 6:05 p.m. to 7:05 p.m. | 0.2 | 0.034 | 2.1 | 1.8 | 0.2 | 0.001 | 0.001 | 0.005 | 0.004 | 0.000 | | 0.001 | 6 | 4 | 1 | 0 |
| | | 7:05 p.m. to 8:05 p.m. | 0.1 | 0.034 | 2.0 | 1.8 | 0.1 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | | 0.000 | 4 | 3 | 1 | 0 |
| 13-Feb-02 | Site # 3 | 8:25 a.m. to 9:25 a.m. | 0.1 | 0.028 | 2.2 | 2.2 | 0.0 | 0.000 | 0.001 | 0.006 | 0.006 | 0.000 | | 0.001 | 4 | 4 | 1 | 2 |
| | Site # 12 | 9:58 a.m. to 10:58 a.m. | 0.1 | 0.033 | 2.8 | 1.8 | 1.1 | 0.001 | 0.002 | 0.003 | 0.004 | 0.000 | | 0.001 | 4 | 2 | 0 | 1 |
| | | 10:58 a.m. to 11:58 a.m. | 0.1 | 0.034 | 1.9 | 1.7 | 0.0 | 0.001 | 0.001 | 0.002 | 0.003 | 0.000 | | 0.000 | 1 | 1 | 0 | 0 |
| | Site # 11 | 12:19 p.m. to 1:19 p.m. | 0.1 | 0.035 | 1.9 | 1.7 | 0.0 | 0.000 | 0.001 | 0.002 | 0.003 | 0.001 | no data | 0.000 | 2 | 1 | 0 | 6 |
| | Site # 15 | 3:13 p.m. to 4:13 p.m. | 0.1 | 0.035 | 2.0 | 1.8 | 0.1 | 0.001 | 0.007 | 0.004 | 0.011 | 0.000 | | 0.000 | 3 | 2 | 1 | 1 |
| | Site # 17 | 4:58 p.m. to 5:58 p.m. | 0.0 | 0.029 | 2.5 | 2.2 | 0.1 | 0.001 | 0.010 | 0.012 | 0.022 | 0.001 | | 0.001 | 7 | 5 | 1 | 3 |
| | Site # 14 | 6:16 p.m. to 7:16 p.m. | 0.0 | 0.033 | 2.1 | 1.9 | 0.1 | 0.001 | 0.003 | 0.005 | 0.008 | 0.000 | | 0.000 | 3 | 2 | 1 | 5 |
| 14-Feb-02 | Site # 6 | 10:39 a.m. to 11:39 a.m. | 0.1 | 0.031 | 2.1 | 2.1 | 0.0 | 0.002 | 0.006 | 0.005 | 0.011 | 0.001 | | 0.000 | 4 | 2 | 0 | 1 |
| | Site # 10 | 12:33 p.m. to 1:33 p.m. | 0.1 | 0.033 | 2.4 | 2.3 | 0.0 | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | | 0.000 | 9 | 6 | 1 | 1 |
| | | 1:33 p.m. to 2:33 p.m. | 0.1 | 0.034 | 2.4 | 2.3 | 0.0 | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | no data | 0.000 | 7 | 5 | 1 | 1 |
| | Site # 9 | 3:07 p.m. to 4:07 p.m. | 0.1 | 0.038 | 2.2 | 2.1 | 0.0 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | | 0.000 | 6 | 4 | 1 | 0 |
| | Site # 5 | 4:40 p.m. to 5:40 p.m. | 0.1 | 0.036 | 2.3 | 2.3 | 0.0 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | | 0.000 | 8 | 6 | 1 | 0 |
| 15-Feb-02 | Site # 14 | 10:08 a.m. to 11:08 a.m. | 0.3 | 0.036 | 3.4 | 2.4 | 1.3 | 0.000 | 0.004 | 0.003 | 0.008 | 0.000 | 0.002 | 0.001 | 6 | 5 | 2 | 1 |
| | Site # 17 | 11:23 a.m. to 12:23 p.m. | 0.3 | 0.034 | 3.3 | 2.9 | 0.6 | 0.000 | 0.014 | 0.009 | 0.023 | 0.002 | 0.002 | 0.000 | 7 | 5 | 1 | 8 |
| | Site # 15 | 1:14 p.m. to 2:14 p.m. | 0.2 | 0.037 | 5.2 | 3.3 | 2.6 | 0.001 | 0.010 | 0.005 | 0.015 | 0.002 | 0.002 | 0.001 | 7 | 5 | 1 | 1 |
| **one-hour guideline** | | | **13.0** | **0.082** | | **n/a** | | **0.170** | **n/a** | **0.210** | **n/a** | **2.0** | **n/a** | **0.010** | | | **n/a** | |

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

ng/m$^3$ - nanograms per cubic metre of air
ug/m$^3$ - micrograms per cubic metre of air
ppm - parts per million

**List of Air Quality Parameters**

CO - carbon monoxide
$O_3$ - ozone
THC - total hydrocarbons
$CH_4$ - methane
RHC - reactive hydrocarbons
$SO_2$ - sulphur dioxide
NO - nitric oxide
$NO_2$ - nitrogen dioxide
$NO_x$ - total oxides of nitrogen
$NH_3$ - ammonia
TRS - total reduced sulphur
$H_2S$ - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
$PM_{10}$ - inhalable particulates
$PM_{2.5}$ - respirable particulates

## Table A9 Weather Conditions and Operator's Remarks in the Cold Lake, Bonnyville and Elk Point areas survey. (March 26 to 30, 2001).

| Date | Monitoring Location | Time (MST) | Temp °C | RH % | WSP km/h | WDR | Cloud % | Operator's Remarks |
|---|---|---|---|---|---|---|---|---|
| 26-Mar-01 | Site # 1 | ( 2:58 p.m. to 3:58 p.m.) | 2 | 53 | 5 | W | 100 | Elevated readings CO, NO, $NO_2$, PAH due to heavy equipment operating in the area. |
| | Site # 2 | ( 4:42 p.m. to 5:42 p.m.) | 1 | 68 | 8 | W | 100 | LaCorey Ranger Stn. No rain. No elevated readings. |
| | Site # 3 | ( 6:32 p.m. to 7:32 p.m.) | 0 | 77 | 4 | W | 100 | ~1 km directly E of AEC Trucking terminal on Rge 455. CO, NO, $NO_2$ from traffic. |
| 27-Mar-01 | Site # 5 | ( 9:30 a.m. to 10:30 a.m.) | 6 | 35 | 9 | W | Sunny | Blackrock Oil & Gas is 3 miles N of property. No odours, no elevated readings. |
| | Site # 6 | (11:25 a.m. to 12:25 p.m.) | 9 | 26 | 12 | W | Sunny | 1 km E of site #6. Elevated TSP, $PM_{10}$, $Pm_{2.5}$, & PAH from wood burning - land clearing for future facility. |
| | Site # 9 | ( 1:35 p.m. to 2:35 p.m.) | 10 | 24 | 8 | W | Sunny | 700m W of 1st Nations property on Twp 640 about 500m E of Hwy 897. Elevated particulate from road dust. |
| | Site # 8 | ( 2:50 p.m. to 3:50 p.m.) | 10 | 25 | 4 | SW | Sunny | Residential property. No elevated readings. |
| | Site # 7 | ( 4:12 p.m. to 5:12 p.m.) | 10 | 21 | 6 | SW | Sunny | Corner of Twp 650 & Hwy 897. No elevated readings. |
| | Site # 10 | ( 5:47 p.m. to 6:47 p.m.) | 8 | 27 | 3 | SW | Sunny | Cold Lake Marina. Elevated CO, NO,$NO_2$, & particulate due to high traffic & dusty roads. |
| | Site # 4 | ( 7:43 p.m. to 8:43 p.m.) | 2 | 45 | 8 | SE | na | Corner of Rge 444 & Twp 615. Downwind of old Suncor site. No elevated readings |
| 28-Mar-01 | Site # 1 | ( 8:45 a.m. to 9:45 a.m.) | 3 | 64 | 12 | S | 100 | Elevated CO, NO, $NO_2$ & particulate from heavy duty equipment operating in the area. |
| | Site # 4 | (10:11 a.m. to 11:11 a.m.) | 4 | 59 | 15 | SW | 100 | Corner of Rge 444 & Twp 615. Downwind of old Suncor site. No elevated readings. |
| | Site # 2 | (11:58 a.m. to 12:58 p.m.) | 5 | 58 | 10 | W | 100 | LaCorey Ranger Stn. No elevated readings. |
| | Site # 3 | ( 1:06 p.m. to 2:06 p.m.) | 8 | 50 | 13 | W | 100 | ~1 km directly E of AEC Trucking terminal on Rge 455. No elevated readings. |
| | Site # 12 | ( 2:57 p.m. to 3:57 p.m.) | 9 | 36 | 15 | W | 100 | On plant site for 2 hours. Flare is 500m west of MAML. Elevated CO, NO2 & particulate |
| | | ( 3:58 p.m. to 4:57 p.m.) | 8 | 27 | 15 | W | 100 | due to vehicles going by on the same road. |
| | Site # 11 | ( 5:06 p.m. to 6:06 p.m.) | 7 | 27 | 18 | W | 100 | Upwind of site #12. This is the main road NW of plant & the road back to LaCorey. Plant is ~ 1km SE of MAML. |
| 29-Mar-01 | Site # 5 | ( 8:46 a.m. to 9:46 a.m.) | 4 | 42 | 14 | NW | 5 | Start 1 hour ave at site # 5 |
| | Site # 6 | (10:09 a.m. to 11:09 a.m.) | 4 | 39 | 20 | W | 5 | 1 km E of Imperial Oil Landfill site (8-33-64-3 W4M). |
| | Site # 9 | (11:45 a.m. to 12:45 p.m.) | 7 | 27 | 16 | W | sunny | Elevated particulate from high winds blowing dust off road & PAH from diesel exhaust. |
| | Site # 8 | (12:57 p.m. to 1:56 p.m.) | 6 | 26 | 19 | W | 50 | Elevated particulate from high winds blowing dust, etc. |
| | Site # 7 | ( 2:10 p.m. to 3:10 p.m.) | 9 | 20 | 13 | W | 60 | Corner of Twp 650 & Hwy 897. Elevated particulate from high winds blowing dust, etc. |
| | Site # 10 | ( 3:32 p.m. to 4:32 p.m.) | 8 | 24 | 11 | NW | 70 | Cold Lake Marina. Elevated particulate from road dust. |
| 30-Mar-01 | Site # 14 | ( 9:24 a.m. to 10:23 a.m.) | 0 | 51 | 25 | N | 60 | Downwind of site #14 for 2 hours. 400m east of Hwy 657 on Twp 572. Pick up odours. |
| | | (10:24 a.m. to 11:25 a.m.) | 0 | 47 | 24 | NW | 60 | |
| | Site # 16 | (12:07 p.m. to 1:06 p.m.) | 2 | 40 | 35 | NW | 70 | Corner of Twp 573 & Rge 65 about 1 mile from Anadarka Battery. Monitor for 2 hours. |
| | | ( 1:07 p.m. to 2:08 p.m.) | 2 | 35 | 35 | NW | 70 | |
| | Site # 15 | ( 3:20 p.m. to 4:19 p.m.) | 3 | 28 | 26 | N | 30 | Onsite at Site #15 downwind of large drum containers (odours). Monitor for 2 hours. |
| | | ( 4:20 p.m. to 5:21 p.m.) | 3 | 27 | 24 | N | 30 | Particulates during the hour are from high wind & vehicle road dust. |

*Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V - indicates the wind was from variable conditions. N/a indicates no data available.

## Table A10 Weather Conditions and Operator's Remarks in the Cold Lake, Bonnyville and Elk Point areas survey. (July 30 to August 3, 2001).

| Date | Monitoring Location | Time (MST) | Temp (°C) | RH (%) | WSP (km/h) | WDR | Cloud (%) | Operator's Remarks |
|---|---|---|---|---|---|---|---|---|
| 30-Jul-01 | Site # 16 | (11:29 a.m. to 12:28 p.m.) | 21 | 63 | 15 | W | 100 | Rge Rd 65 & Twp Rd 573 about 1 mi. SE of Anadarka. |
| | | (12:29 p.m. to 1:30 p.m.) | 21 | 63 | 17 | W | 100 | |
| | Site # 3 | ( 2:31 p.m. to 3:31 p.m.) | 23 | 50 | 21 | W | 100 | AEC La Corey stn. gate entrance. Nearest storage container 104m SE of MAML. No rain. |
| | Site # 2 | ( 3:46 p.m. to 4:46 p.m.) | 22 | 48 | 20 | NW | 90 | Monitor SE corner of Hwy 41 & Hwy 55 for particulate from traffic at 4-way stop sign. Elevated particulate & PAH from vehicles & diesel trucks. |
| | Site # 1 | ( 5:03 p.m. to 6:02 p.m.) | 21 | 51 | 10 | W | 90 | Lakeside Dr. & 51st.$H_2S$ peak of 5 ppb - wind from the S (Jessie Lake) when $H_2S$ was measured. |
| | | ( 6:03 p.m. to 7:03 p.m.) | 19 | 71 | 9 | SW | 90 | |
| 31-Jul-01 | Site # 5 | ( 7:29 a.m. to 8:30 a.m.) | 20 | 69 | 4 | W | Sunny | Private residence. Little or no wind. |
| | Site # 6 | ( 9:03 a.m. to 10:04 a.m.) | 25 | 41 | 6 | SW | Sunny | Downwind of Imperial's Leming plant ~ 430m E of storage drums. Intermittent odours & slightly increased HC's. |
| | Site # 9 | (11:02 a.m. to 12:03 p.m.) | 24 | 45 | 7 | W | na | 200m E of Hwy 897 on Twp Rd 640. |
| | Site # 8 | (12:14 p.m. to 1:15 p.m.) | 26 | 40 | 3 | SW | 20 | Private residence. Sunny with light west winds- No elevated readings. |
| | Site # 7A | ( 1:27 p.m. to 2:28 p.m.) | 24 | 49 | 5 | S | 30 | Hwy 897 & Twp Rd 560. Sunny with light W winds. No elevated readings. |
| | Site # 10 | ( 3:03 p.m. to 4:04 p.m.) | 26 | 35 | 6 | W | 30 | Marina parking lot. Pick up exhaust & particulate from local traffic. |
| | | ( 4:04 p.m. to 5:04 p.m.) | 25 | 42 | 4 | S | 30 | |
| | Site # 4 | ( 5:42 p.m. to 6:43 p.m.) | 23 | 43 | 10 | NW | 20 | Adjacant to the old Suncor site which is owned by CNRL (now called CNRL Charlotte). On Twp Rd 614 between Rge Rd 43 & 44. Slightly elevated HC's. |
| | | ( 6:43 p.m. to 7:43 p.m.) | 22 | 51 | 7 | NW | 20 | |
| 1-Aug-01 | Site # 12 | ( 7:32 a.m. to 8:33 a.m.) | 20 | 66 | 2 | SW | Sunny | On CNRL property about 290m E of main flare stack. Downwind site. Pick up RHC peak 9.9 ppm, $H_2S$ peak 12 ppb & TRS peak 12 ppb. |
| | | ( 8:33 a.m. to 9:33 a.m.) | 23 | 54 | 3 | SW | Sunny | |
| | Site # 11 | ( 9:44 a.m. to 10:45 a.m.) | 24 | 49 | 5 | S | Sunny | Upwind site. 1km NW of CNRL plant site on Hwy 41. |
| | Site # 14 | (12:44 p.m. to 1:45 p.m.) | 25 | 41 | 7 | S | 80 | NE corner of Anadime property 82m N of storage tanks. RHC peak 5.7ppm, $H_2S$ peak 3 ppb, & TRS peak 5 ppb. |
| | Site # 17 | ( 2:16 p.m. to 3:17 p.m.) | 27 | 34 | 11 | SW | 60 | 100m S of Railway Ave. & ~ 10m W of road in a field. |
| | Site # 15 | ( 4:11 p.m. to 5:12 p.m.) | 28 | 32 | 10 | SE | 30 | ~40m from the nearest storage tank on the NE side of the plant- Elevated THC (peaked off scale >20ppm) and $H_2S$ (peak 4ppb). Elevated particulate from truck traffic. |
| 2-Aug-01 | Site # 3 | ( 7:24 a.m. to 8:25 a.m.) | 22 | 61 | 3 | SE | Sunny | ~ 1km E of Hwy 41 on Twp Rd 634A. |
| | Site # 2 | ( 8:34 a.m. to 9:35 a.m.) | 23 | 57 | 4 | SW | Sunny | NW corner of Hwy 41 & Hwy 55 intersection. Elevated vehicle emissions & particulates. |
| | Site # 7 | (10:22 a.m. to 11:23 a.m.) | 27 | 47 | 3 | SE | Sunny | Private residence. No elevated readings. |
| | Site # 8 | (11:53 a.m. to 12:54 p.m.) | 29 | 40 | 2 | W | Sunny | Private residence. No elevated readings. |
| | Site # 9 | ( 1:13 p.m. to 2:14 p.m.) | 31 | 34 | 4 | SW | Sunny | 200m E of Hwy 897 on Twp Rd 640. No elevated readings. |
| | Site # 6 | ( 2:52 p.m. to 3:53 p.m.) | 28 | 36 | 11 | W | Sunny | Downwind of Maskwa site on the N side ~ 213m from nearest stacks & storage tanks. No activity from these stacks. Nearest flare stacks are 366m & 401m SE of MAML. Pick up |
| | Site # 5 | ( 4:12 p.m. to 5:13 p.m.) | 28 | 35 | 8 | W | Sunny | Private residence. No elevated readings. |
| 3-Aug-01 | Site # 14 | ( 7:39 a.m. to 8:40 a.m.) | 22 | 61 | 8 | SE | Sunny | Downwind of storage tanks. Nearest tank is 75m SE of MAML. Pick up THC, $H_2S$ & TRS. |
| | Site # 17 | ( 8:57 a.m. to 9:58 a.m.) | 26 | 47 | 12 | SE | Sunny | N side of plant site 41m from semi's unloading used product. Elevated THC, $NO_x$ & particulates from road dust. |
| | Site # 15 | (10:37 a.m. to 11:38 a.m.) | 28 | 35 | 19 | SE | Sunny | N side of the CNRL office bldg. 221m NW of nearest storage facility. 10:42 AM - Pick up vehicle & diesel emissions from heavy truck traffic on site. Elevated CO, PAH, THC & |

*Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V - indicates the wind was from variable conditions. N/a indicates no data available.

## Table A11 Weather Conditions and Operator's Remarks in the Cold Lake, Bonnyville and Elk Point areas survey. (September 10 to 14, 2001).

| Date | Monitoring Location | Time (MST) | Temp (°C) | RH (%) | WSP (km/h) | WDR | Cloud (%) | Operator's Remarks |
|---|---|---|---|---|---|---|---|---|
| 10-Sep-01 | Site # 16 | (11:20 a.m.to 12:21 p.m.) | 10 | 73 | 17 | W | 100 | 1 mi. N of Twp Rd 572 on Rge Rd 65 & sitting 1 mi SE of site #16. Very light rain. |
| | | (12:31 p.m. to 1:32 p.m.) | 13 | 58 | 13 | W | 100 | 25m E of nearest tank. Pick up normal odors from tanks. Elevated HC's. $CH_4$ peak (10ppm), RHC peak (7ppm). |
| | Site # 3 | ( 2:21 p.m. to 3:22 p.m.) | 12 | 67 | 10 | W | 95 | Gate entrance, 104m from large storage drums. |
| | Site # 2 | ( 3:28 p.m. to 4:29 p.m.) | 11 | 74 | 7 | SW | na | Willow Prairie Hall in La Corey. 10m east of Hwy41 at the Hall. The Hall sits along Hwy41 ~ |
| | | ( 4:28 p.m. to 5:29 p.m.) | 11 | 79 | 5 | W | na | 1.5 blocks N of Hwy 55. No elevated readings. |
| | Site # 1 | ( 5:50 p.m. to 6:51 p.m.) | 10 | 87 | 5 | W | 95 | 2 hr. sampling. Lakeside Dr. & 51 St. No elevated readings. |
| | | ( 6:50 p.m. to 7:51 p.m.) | 9 | 92 | 4 | NW | 95 | |
| 11-Sep-01 | Site # 5 | ( 8:02 a.m. to 9:03 a.m.) | 9 | 87 | 5 | W | 100 | Hilda lake, Private residence. No elevated readings. 2 hours here. |
| | | ( 9:02 a.m. to 10:03 a.m.) | 10 | 79 | 6 | SW | 100 | |
| | Site # 6 | (10:45 a.m. to 11:46 a.m.) | 9 | 77 | 6 | SW | 100 | 430m downwind of Imperial's Leming Plant on the SE side. Intermittent odours & slightly increased HC's. |
| | Site # 9 | (12:22 p.m. to 1:23 p.m.) | 11 | 68 | 10 | W | na | 200m E of Hwy 897on Twp Rd 640. No elevated readings. |
| | Site # 8 | ( 1:35 p.m. to 2:36 p.m.) | 12 | 70 | 4 | W | 100 | Private residence at Ethel Lake. No rain. No elevated readings. |
| | Site # 7 | ( 2:56 p.m. to 3:57 p.m.) | 11 | 72 | 5 | W | 100 | Private residence. No rain. No elevated readings. |
| | Site # 10 | ( 4:28 p.m. to 5:29 p.m.) | 13 | 59 | 8 | W | 85 | Marina in Cold Lake. Pick up exhaust & particulate from local traffic. 2 hr. sampling. |
| | | ( 5:28 p.m. to 6:29 p.m.) | 11 | 67 | 6 | W | 85 | |
| 12-Sep-01 | Site # 12 | ( 8:14 a.m. to 9:15 a.m.) | 10 | 82 | 5 | SE | 100 | CNRL property 294m NE of main flare stack & 50m from plant. $H_2S$ & TRS will exceed 10 |
| | | ( 9:14 a.m. to 10:15 a.m.) | 12 | 69 | 6 | S | 100 | ppb over 1 hr. Lots of roadwork & brush burning on road to plant. RHC peak 19.9, CH4 peak 9.9 ppm, TRS & $H_2S$ peak 404 ppb. |
| | Site # 11 | (10:22 a.m. to 11:23 a.m.) | 15 | 55 | 6 | S | 95 | ~1km NW of plant site on main rd NW of plant. Same rd back to La Corey. No rain. |
| | Site # 3 | (12:00 p.m. to 1:01 p.m.) | 14 | 49 | 8 | SE | 90 | Farm house 0.5 km NW of AEC's large tanks N of the main facility. Hwy 41 & 1 km N of Twp 634A. |
| | Site # 15 | ( 2:05 p.m. to 3:06 p.m.) | 16 | 36 | 12 | SE | 10 | N side CNRL bldg. 221m NW of nearest storage facility. Slightly elevated THC, $CH_4$ & RHC. Elevated particulate. |
| | Site # 17 | ( 3:38 p.m. to 4:39 p.m.) | 16 | 36 | 11 | SE | na | 100m S of Railway Ave & 10m W of Rge Rd 52. |
| | Site # 14 | ( 5:12 p.m. to 6:13 p.m.) | 14 | 42 | 8 | SE | na | Anadime property 72m NW of nearest tanks. Pick up odours. Slightly elevated HC's. |
| | Site # 4 | ( 6:58 p.m. to 7:59 p.m.) | 8 | 77 | 3 | E | 40 | Rge Rd 444 & Twp Rd 615 ~ 1 mi. NW of the old Suncor site. Odours at the start of the |
| | | ( 7:58 p.m. to 8:59 p.m.) | 7 | 80 | 3 | E | 40 | sampling time, no odours during most of the sampling period. Small elevation in HC's. |
| 13-Sep-01 | Site # 7 | ( 8:40 a.m. to 9:41 a.m.) | 10 | 92 | 5 | SE | 100 | Hwy 897 & Twp Rd 650. No rain but ground is wet from rain overnight. |
| | Site # 8 | ( 9:51 a.m. to 10:52 a.m.) | 12 | 85 | 5 | SE | na | Private residence on Ethel Lake. No elevated readings. |
| | Site # 9 | (11:01 a.m. to 12:02 p.m.) | 14 | 73 | 5 | SE | 100 | 200m E of Hwy 897 on Twp Rd 640. No rain. No elevated readings. |
| | Site # 6 | (12:31 p.m. to 1:32 p.m.) | 15 | 65 | 12 | SW | 100 | Downwind on the N side of Maskwa site 214m from the nearest stacks & storage tanks. No activity from the nearest stacks or 2 flare stacks which are 386m & 421m SE of MAML. Heavy odours. $CH_4$ peak 5 ppm, RHC peak 11.6 ppm, $SO_2$ peak 130 ppb, $NO_x$ peak 116 ppb, $NO_2$ peak 28 ppb, H2S & TRS peak 12 ppb. Also picking up truck traffic emissions. |
| 14-Sep-01 | Site # 14 | ( 7:51 a.m. to 8:52 a.m.) | 11 | 69 | 9 | E | na | 85m NW of nearest tank. Detect odours. Slight elevation of HC's. |
| | Site # 17 | ( 9:20 a.m. to 10:21 a.m.) | 18 | 51 | 5 | S | Sunny | Railway Ave. (RR 52) & Main St. in Lindbergh, downwind of plant site located at NW 34-56-5 W4M. |
| | Site # 15 | (11:01 a.m. to 12:02 p.m.) | 24 | 35 | 4 | S | Sunny | E side of plant ~ 50m from truck loading/unloading site. Variable winds cause interference from generator emissions. Picking up HC's from loading/unloading.$CH_4$ peak 5 ppm, RHC |

*Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V - indicates the wind was from variable conditions. N/a indicates no data available.

## Table A12 Weather Conditions and Operator's Remarks in the Cold Lake, Bonnyville and Elk Point areas survey. (February 11 to 15, 2002).

| Date | Monitoring Location | Time (MST) | Temp (°C) | RH (%) | WSP (km/h) | WDR | Cloud (%) | Operator's Remarks |
|---|---|---|---|---|---|---|---|---|
| 11-Feb-02 | Site # 16 | ( 1:00 p.m. to 2:00 p.m.) | 1 | 68 | 37 | NW | 0 | Strong winds from the NW up to 65 kph. No elevated readings. 2 hr. sampling. |
| | | ( 2:01 p.m. to 3:01 p.m.) | 1 | 61 | 32 | NW | 0 | |
| | Site # 3 | ( 4:20 p.m. to 5:20 p.m.) | 0 | 66 | 35 | NW | 100 | 50m E of Hwy 41. AEC Trucking. No elevated readings. |
| | Site # 2 | ( 5:30 p.m. to 6:30 p.m.) | 0 | 61 | 20 | NW | 100 | SE parking Lot in La Corey at 4 way stop. Slight elevation from traffic exh. $NO_2$, PAH. 2 hr. sampling. |
| | | ( 6:31 p.m. to 7:31 p.m.) | 0 | 64 | 18 | W | 100 | |
| | Site # 1 | ( 7:51 p.m. to 8:51 p.m.) | -2 | 65 | 9 | W | Dark | Lakeside Drive & 51 St. in Bonnyville. Slight elevation from traffic exh. $NO_2$, PAH. No elevated readings. |
| | | ( 8:52 p.m. to 9:52 p.m.) | -3 | 66 | 8 | W | Dark | |
| 12-Feb-02 | Site # 5 | ( 8:40 a.m. to 9:40 a.m.) | -6 | 73 | 7 | NW | 20 | No elevated readings. |
| | Site # 6 | (10:12 a.m. to 11:12 a.m.) | 0 | 57 | 6 | W | 10 | Downwind on NE side of Esso Leming plant ~ 261m from main stack. Odours. Road dust, $NO_x$, CO from traffic. |
| | Site # 7A | (12:02 p.m. to 1:02 p.m.) | 1 | 51 | 8 | SW | 50 | Twp Rd 650 & Hwy 897. Road dust, CO from traffic. |
| | | ( 1:02 p.m. to 2:02 p.m.) | 2 | 50 | 8 | SW | 50 | |
| | Site # 8 | ( 2:10 p.m. to 3:10 p.m.) | 3 | 57 | 14 | SW | 40 | Ethel Lake campsite. No elevated readings |
| | | ( 3:10 p.m. to 4:10 p.m.) | 4 | 54 | 22 | W | 40 | |
| | Site # 9 | ( 4:22 p.m. to 5:22 p.m.) | 2 | 61 | 7 | W | 50 | 100m E of Hwy 897 on Twp Rd 640. No elevated readings. |
| | Site # 4 | ( 6:05 p.m. to 7:05 p.m.) | -1 | 73 | 15 | SW | dark | Gate entrance. No elevated readings. |
| | | ( 7:05 p.m. to 8:05 p.m.) | -2 | 76 | 13 | SW | dark | |
| 13-Feb-02 | Site # 3 | ( 8:25 a.m. to 9:25 a.m.) | -5 | 83 | 9 | NW | 20 | Vehicle exhaust from local traffic. |
| | Site # 12 | ( 9:58 a.m. to 10:58 a.m.) | 1 | 64 | 13 | N | 70 | Pick up RHC & $H_2S$ from plant & particulate from truck traffic around Esso Lemming plant. |
| | | (10:58 a.m. to 11:58 a.m.) | 2 | 62 | 14 | N | 70 | No elevated readings. |
| | Site # 11 | (12:19 p.m. to 1:19 p.m.) | 6 | 43 | 9 | SW | 70 | Traffic exh. at CNRL gate entrance. |
| | Site # 15 | ( 3:13 p.m. to 4:13 p.m.) | 2 | 70 | 12 | NW | 40 | No elevated readings. |
| | Site # 17 | ( 4:58 p.m. to 5:58 p.m.) | 0 | 77 | 4 | NW | 10 | Truck traffic on CCS site. |
| | Site # 14 | ( 6:16 p.m. to 7:16 p.m.) | 0 | 67 | 15 | N | 10 | Mainly hwy traffic exh. at Anadime gate entrance. |
| 14-Feb-02 | Site # 6 | (10:39 a.m. to 11:39 a.m.) | 0 | 54 | 12 | W | 0 | NE side of Mahihkan plant ~ 210m from nearest. Odours. Elevated $NO_x$ & PAH from traffic exh. |
| | Site # 10 | (12:33 p.m. to 1:33 p.m.) | 2 | 49 | 16 | SW | 10 | Stop at the Marina in Cold Lake. Elevated PAH from traffic exh. |
| | | ( 1:33 p.m. to 2:33 p.m.) | 2 | 48 | 17 | SW | 10 | |
| | Site # 9 | ( 3:07 p.m. to 4:07 p.m.) | 3 | 47 | 8 | W | 10 | 100m E of Hwy 897 on Twp Rd 640. No elevated readings. |
| | Site # 5 | ( 4:40 p.m. to 5:40 p.m.) | 1 | 60 | 9 | W | 10 | Gate entrance on the S side. No elevated readings. |
| 15-Feb-02 | Site # 14 | 10:08 a.m. to 11:08 a.m. | 3 | 66 | 19 | W | na | Detect odours. 166m on NE side of plant on service road. Elevated CO, RHC & $NO_x$ from CNRL cleaning plant. |
| | Site # 17 | (11:23 a.m. to 12:23 p.m.) | 7 | 53 | 8 | W | 30 | SE gate entrance to CCS. 11:25 AM - Detect odours. Elevated CO, $NO_x$ & PAH from traffic exh. |
| | Site # 15 | ( 1:14 p.m. to 2:14 p.m.) | 8 | 49 | 10 | W | 40 | E side of plant. Nearest facility is 30m W. CO, RHC, $NO_x$ & PAH from traffic exh. & emissions from plant. |

*Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V - indicates the wind was from variable conditions. N/a indicates no data available.